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THE DISEASES

OF THE

NOSE, THROAT, AND EAR.

BY

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conjoint study of their diseases in the one volume. The secondary nature of the large majority of aural affections, their dependence upon precedent disease within the nose and nasopharynx, is now so universally admitted as almost to justify the assertion that, pathologically and therapeutically, the ear is scarcely more than an appendage of the nose and throat. It is certain, at least, that it is the rhinologist who holds the key to the prophylaxis of the ear, and this comprises no small part of the equipment necessary to control and conquer its diseases.

For permission to use several valuable electrotypes illustrating important anatomical features of the nasal fossæ and their accessory cavities, the author is greatly indebted to Dr. M. H. Cryer, in whose book, *Studies of the Anatomy of the Face*, the originals will be found.

To his publishers, also, a large measure of thanks is due, and the patient care with which they have supervised his work and the timely suggestions with which they have lightened it, are gratefully acknowledged.

C. P. G.

251 SOUTH SIXTEENTH STREET, PHILADELPHIA,
July, 1902.

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DISEASES OF THE NOSE, THROAT, AND EAR.

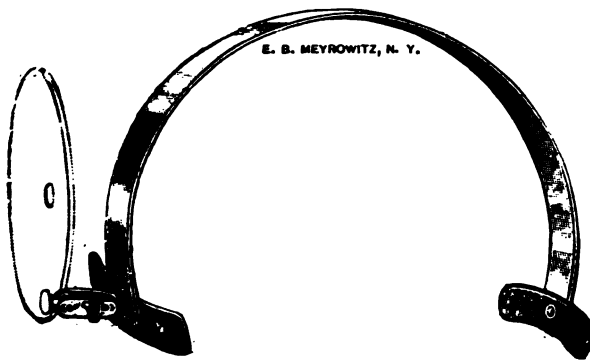
CHAPTER I.

THE SELECTION AND CARE OF INSTRUMENTS.

AMONG the earliest difficulties encountered by one beginning the study of a specialty is the choice of the necessary instruments. Without advice he is exposed on the one hand to the mistakes that may arise from his own inexperience, and on the other to the deceptions that may be practised upon him by unscrupulous dealers. In the practice of rhinolaryngology, while the number of instruments used may be multiplied almost without limit, yet the number actually essential for purposes both of examination and treatment is by no means large. I shall discuss in the following chapter the light to be employed and certain other of the more important articles of office furniture. In this one I shall deal only with those instruments that are, so to speak, a part of the physician himself. Of these the first to engage our attention is the head-mirror. This is to be had in four sizes, ranging, with half-inch increases of diameter, from $2\frac{1}{2}$ to 4 inches. The beginner is apt to err by selecting too large a mirror, supposing, very naturally, that the larger the mirror the more comprehensive will be his view. The one most generally satisfactory, however, is that measuring $3\frac{1}{2}$ inches. With the brilliant artificial light now obtainable this size of mirror is ample for intensity of illumination, and its less weight becomes a matter of some moment when it is worn for any length of time. In choosing the mirror but two precautions are needful. The central perforation should

not be larger than a quarter or three-eighths of an inch in diameter. Anything more than this exposes the eye unnecessarily and diminishes the extent of the reflecting surface. The second relates to the focal distance of the mirror, which should not exceed six or eight inches. This is a point of sufficient importance to make it desirable that the physician should test it for himself rather than rely upon the assurance of the dealer. It may be measured either directly by ascertaining the distance of the solar focus, or, approximately, by diffused daylight, by ascertaining the distance of the image of a remote object. To make

FIG. 1.



Head-mirror attached to metallic head-band.

the use of these mirrors possible without occupying either hand of the examiner, they are framed and attached by means of a ball-and-socket joint to some form of head-band. Of these there is quite a large number, and in choosing from among them a few suggestions may be of assistance. The desirable features of a head-band are lightness, durability, and, so far as possible, the avoidance of pressure upon the vessels of the scalp. The various forms of elastic band are, almost without exception, too tight, too warm for summer use, and too short-lived. A further objection, and not so slight a one as it may at first seem, is that their frequent removal and readjustment occasion an equally frequent

disarrangement of the hair, and, unless this be kept closely cropped, it is apt to be a source of some annoyance. Of the several varieties of head-band that I have employed the one here illustrated (Fig. 1) has proven the most satisfactory for the following reasons: It is light, very durable, affords a firm support for the mirror without constricting the scalp, does not disorder the hair when removed or applied, and occupies but little room in one's instrument satchel. The hard-rubber cross-piece for the forehead has the advantage of being non-absorbent, and is unaffected by the moisture which may collect upon the brow. These bands as they are kept in stock are usually too large for the average head, but they can be readily shortened until they accurately fit the head that is to wear them. A modi-

FIG. 2.



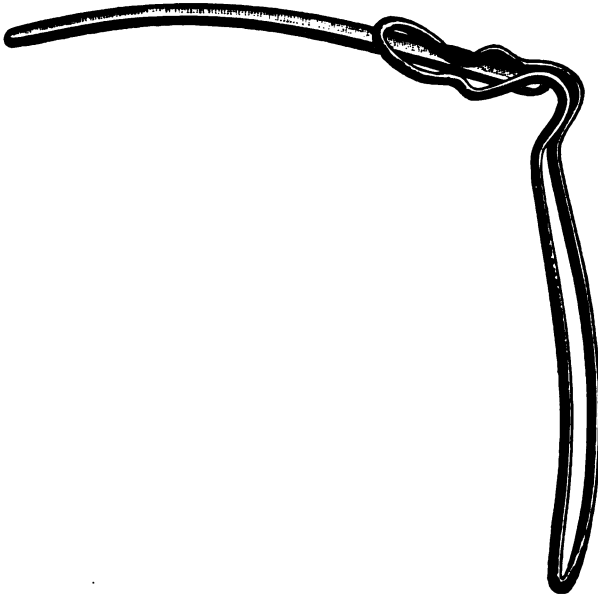
Tongue depressor.

fication of this style of band is jointed, so that it may be folded and carried in the pocket; but these joints are prone to wear loose, and when this occurs the position of the instrument upon the head is too readily disturbed, and the mirror becomes proportionately unsteady.

The Tongue Depressor. The tongue depressor is an instrument in such frequent use that its selection merits considerable care. A dozen or more different models serve to make the choice somewhat difficult, but if certain desirable features of a tongue depressor are remembered it will be found that comparatively few of those that are offered possess them. The one illustrated (Fig. 2) is an excellent instrument. The blades are hinged and are of different lengths, the longer being for adults, the shorter

for children. The distal end of each has its under surface serrated, so that slipping of the tongue from beneath it is impeded. Each of them has, also, a gentle longitudinal curve, the concavity presenting downward, thus avoiding any undue pressure upon the body of the tongue, while the downward projection of the tip secures a sufficiently firm hold upon the base of the tongue to enable one to draw it forward. The blades

FIG. 3.



Tongue depressor with detachable blade.

are not fenestrated, and therefore the tongue is protected to a considerable extent from contact with the many astringent or caustic applications that are made to the fauces or the parts posterior to them.

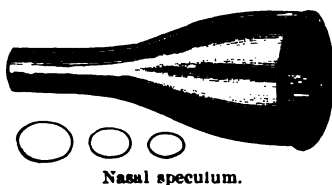
For the several infectious conditions with which the tongue depressor frequently comes in contact, it is imperative that an instrument shall be employed which can either be readily and thoroughly sterilized, or better, perhaps, destroyed. Fig. 3 illus-

trates one consisting of a handle and a removable blade. This latter may be of glass, and therefore easily cleansed, or a thin strip of wood, which may be thrown away after use.

Each of the many other forms of tongue depressor has for its designer, no doubt, some advantage that he regards as indispensable and as not being possessed by any other. With a minimum of practice, however, the one shown in Fig. 2 will be found to be possessed of every real advantage of a practical nature, as well as free from the disadvantages of weight, size, difficulty of cleansing, and many others.

Nasal Speculum. The different varieties of the nasal speculum are all comparatively inexpensive, and a few days or weeks of actual use of each of them will best enable the student to deter-

FIG. 4.



mine with which he is able to do the best work. In the final selection, however, it is as well to consult to some extent the feelings of the patient, and, other things being equal, it will be wise to choose for habitual use that speculum which will be least unpleasant to him. My own experience has led me to regard the nasal modification of the Gruber ear speculum (Fig. 4) as incomparably the best of those that are in general use. The model is enlarged with but little change of shape. Its points of excellence are these: It is small, and there is nothing in its appearance that is apt to alarm the most timid patient. When properly introduced it affords a complete and unobstructed view of the intranasal structures, the vibrissæ, vestibular hairs, being entirely excluded from the field. When once in position the thumb alone will suffice to retain it, while with his disengaged fingers

the physician is enabled to firmly grasp the nose of the patient, to steady his head or to move it in any direction that the examination may require. In children this controlling grasp upon the nose will be found of particular value. For the ordinary purposes of inspection and medication these specula are sold in nests of three, the graded sizes being suited to different

FIG. 5.



Operating speculum.

ages, while for the carrying out of surgical procedures three larger sizes (Allen's) are provided (Fig. 5), which give a much wider field of view, with proportionate increase of illumination, and which permit the introduction of any of the snares, saws, or knives designed for nasal use.

I can find little to say in favor of the many self-retaining, valvular, and other more or less ingenious specula that are offered

FIG. 6.



the rhinologist. They all permit the entrance of the vibrissæ into the field of view—to me an insurmountable objection. Almost all of them are disagreeable to the adult and inspire apprehension in the mind of the child, and, finally, they permit to only a limited extent, if at all, that grasp of the nose which, as I have said, is such a valuable feature of the Gruber speculum.

In spite of these facts, however, a large number of rhinologists prefer some form of valvular or spring speculum. Fig. 6 shows a variety that is in very extensive use. It is one of the several modifications, and the best of them, of the original Kramer ear speculum. I suspect that its popularity is largely the result of the ease with which its introduction can be effected. The blades being closed while it is inserted within the nostril, no difficulty is experienced in this manœuvre, and to the average beginner this constitutes a powerful recommendation. When we discover, however, that upon the subsequent opening of the blades and dilatation of the vestibule the vibrissæ spring between them and obscure our view, that our hold upon the patient's nose is very

FIG. 7.



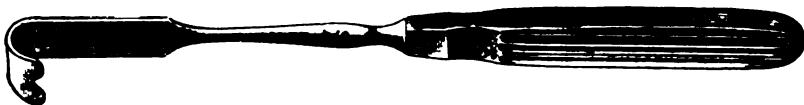
Self-retaining speculum.

insecure, and that we therefore have very little control over the steadiness or movements of his head, our first favorable impression of the instrument will be found to have been somewhat misleading. Moreover, the septal mucous membrane is apt to be frequently wounded by contact with the edges of the metal blades, any sudden movement of the patient greatly contributing to the probability of the accident, and much time may be lost before the resulting hemorrhage can be checked. Again, the appearance of this instrument is very much against it, particularly in the eyes of the child. It is too suggestive of a pair of forceps to find favor with children, and I have never met one who did not betray evidences of alarm when it was first used.

Of the many self-retaining or spring specula the one illustrated (Fig. 7) has seemed to me the best. There are times and conditions when it can with advantage be substituted for the Gruber.

Certain sharp anterior deflections of the septum may prevent the introduction of the latter, and require for their examination and operative correction merely the wide distention of the *alæ* which this speculum will give. Rarely, also, large mucous polypi

FIG. 8.



Palate retractor.

or sarcomata are found projecting into and filling the vestibule, and the examination and removal of these are facilitated by this spring speculum.

Another instrument that is occasionally of great service in the making of a complete examination of the nasopharynx and its contents is the palate retractor. For purposes of examination merely, one of these (Fig. 8) can be introduced behind the soft palate,

FIG. 9.



White's self-retaining retractor.

and this structure then drawn forward sufficiently to give in the postnasal mirror an extensive view of the upper pharyngeal cavity. In the operative removal of neoplasms from this cavity, however, which may require the use of both hands, a self-retaining form of retractor may be employed. White's (Fig. 9) is the one best known, and a little experience with it will demonstrate its very great value. When we have become sufficiently familiar

with it to have acquired some skill and quickness in its introduction, few patients will complain of any discomfort attending its use. To minimize this, however, it will be advisable to precede its placement by cocaineizing with a 4 per cent. solution the posterior and upper surface of the soft palate. If this be done any gagging or opposition on the part of the palatal muscles will be greatly restrained.

Laryngeal Mirrors. To the novice these mirrors, good or bad, will probably all look alike, and it is to protect him from the latter that I advise a close inspection of their material and construction. The glass should first receive his attention, and its whiteness, an essential quality, may be tested by reflecting in it

FIG. 10.



Laryngeal mirror, with universal handle.

a white surface, such as that of a visiting card. A greenish or bluish tint should cause its rejection. The metal backing should be of the best German silver, and the rim which clamps the glass should not encroach upon its surface more than 1 mm. This rim, by the way, should be so closely fitted to the glass that the water and antiseptic solutions in which the mirror is being constantly plunged cannot find their way beneath it. If moisture makes its way to the material which gives the glass its reflecting power it will quickly become useless.

The less the thickness of the mirror the less room it will occupy in the throat—quite an obvious advantage. The shaft connecting the mirror with the handle should be firm enough to

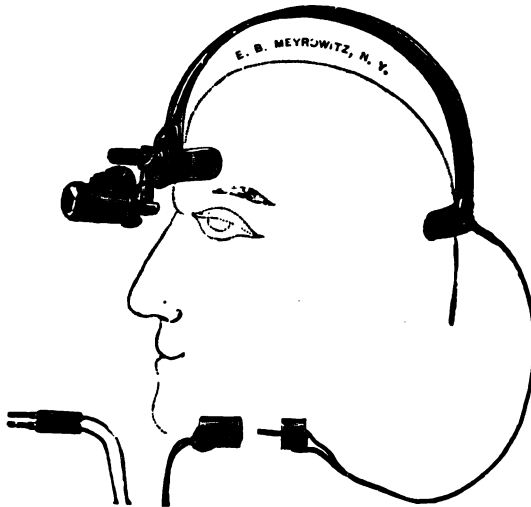
overcome the resistance of the palatal muscles without bending, and it should be so securely fastened to the mirror that there will be no danger of the latter breaking off and perhaps falling into the larynx or being swallowed. On the score of economy the so-called universal handle is to be preferred to the one that is permanently attached to the mirror. Even with more than ordinary care the period of usefulness of a mirror in constant service is only a matter of a few months, and, at the end of this time, it is a needless extravagance to throw away both mirror and handle. The double loss can be averted by employing the "universal."

Six sizes of throat mirrors are usually to be had, No. 1, the smallest, being a half-inch in diameter, while each succeeding number is an eighth of an inch larger than its predecessor. If the beginner procures the four numbers from 2 to 5 he will have all that he will be at all likely to use with any success. The No. 1, intended almost exclusively for posterior rhinoscopy, is so small that the image obtained in it would convey little if any information to one who was not thoroughly familiar with the parts under examination. The No. 6 would be available only in exceptionally capacious as well as tractable throats, and, unless for purposes of demonstration or the performance of some intralaryngeal operation, would very rarely be used.

The Light. It is quite unnecessary at this day to compare the advantages of natural and artificial light as means of illuminating the various recesses of the nose and throat. In the features of brilliance and cheapness it goes without saying that there is no other light comparable to that of the sun, but it is equally self-evident that its use is wholly impracticable. Sunshine is not to be summoned by pushing a button or turning a key, and so since it is not dependable it only remains for us to agree upon the best obtainable substitute. Oil, gas, and electricity are at our service. If nothing better is to be had the first of these will do very well in a student lamp, the flame being

somewhat concentrated by a fenestrated chimney of tin which slips down over the inner glass chimney. More brilliant than this, but lacking its steadiness and slight cost, is some form of electric light. The expense of this, however, is by no means inconsiderable, and an additional disadvantage is the constant presence in the centre of the illuminated field of the shadow of the platinum wire loop. By many specialists this is found to be exceedingly disconcerting and a sufficient reason for discarding this source of light.

FIG. 11.



Electric head-lamp.

Electricity, however, provides us with a headlight (Fig. 11) which is a very great convenience in making examinations or performing operations at the home of the patient. An easily portable storage or dry-cell battery is the best source of supply for the current, the light from which should be of from two to four candle-power.

Gas then remains to us for general use ; and from this, by the aid of certain accessories, so admirable a light may be obtained that we need scarcely regret the impracticability of the sun. The

Argand burner used in conjunction with the Mackenzie condenser (Fig. 12) gives a satisfactory light, and one that fully answers the actual requirements for purposes of diagnosis and treatment. Even a greater intensity of illumination, however, with a whiteness that approaches very closely to that of the solar rays, is given by the Welsbach light, and when this is used with a good condenser the practitioner will have no cause to wish for anything better.

As to the variety of fixture with which this light is used, a word or two. The wall-bracket is yet unmade that will not wear

FIG. 12.



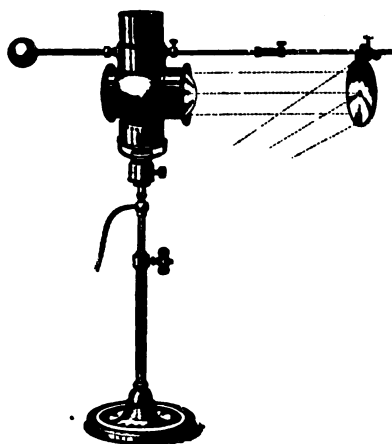
Mackenzie condenser.

loose with the weight that it must carry and the constant movement to which it is subjected by the specialist in active practice. There are some that are much more durable and generally satisfactory than others, but they all alike begin to leak sooner or later, and then they menace one's health as well as try the temper. As the result of a rather varied experience with different sorts of gas-fixtures, my preference has been given to the one here illustrated. (Fig. 13.) Its lateral movement is only limited by the size of the table on which it stands, and it may

be raised or lowered eighteen inches by means of the telescopic arrangement of an inner tube. It can be purchased without the bracket attachment for the mirror.

The Chair. A great deal of elaborate office furniture has been marketed during the past few years, and we may be led into many useless extravagances by a number of chairs and tables and cabinets that appeal to our eye rather than to our judgment. One's actual needs in articles of this kind are very limited and simple. A revolving chair, rather shallow, with arms and a high

FIG. 13.



Gas stand with condenser.

back, is appropriate for the patient, and for the physician the best seat is an ordinary stool, the revolving top of which permits of its being readily raised or lowered.

An article that is scarcely secondary in importance to the two chairs is the cuspidor. At the earliest moment that one's means justify it some form of fountain cuspidor should be obtained. Upon entering your office nothing is more disturbing to the patient of even ordinary sensibility than traces of some previous patient's disease or suffering. Blood, mucus, sputum, and the possible odors associated with them should be immediately

washed away. To be sure, the fountain cuspidor is apt to be somewhat expensive in itself, and its installation necessitates more or less plumbing, but its advantages more than compen-

FIG. 14.



The Peters fountain cuspidor.

sate for the seeming extravagance. Probably the least costly, and at the same time the most satisfactory of them, is the Peters. (Fig. 14.) This has a wide bowl, a free flow of water and a large waste-pipe, and is not at all unsightly.

CHAPTER II.

EXAMINATION OF THE PATIENT.

UPON the thoroughness of his examination and the accuracy of his observation depend the success of the physician as a diagnostician ; and upon the skill, the gentleness, and the rapidity with which he makes this examination will largely depend his more material success in the acquisition of an extensive practice. In the early weeks or months of his work the student of this specialty cannot be too patient and painstaking in his endeavors to master its technical details. It is to be regretted that we cannot all acquire the remarkable manipulative skill of a Morrell Mackenzie, for instance ; but, though we may fall short of him in this respect, there is no need for us to acknowledge any rival in the matters of gentleness and patient thoroughness. It is a grave blunder for the young specialist to imagine that his patients are to be impressed by the display of a sort of breezy carelessness in the handling of his instruments, or, on the other hand, that they are at all likely to become suspicious of his ability should he choose to be deliberate and to repeat his examination several times before committing himself to a diagnosis. "The more haste the less speed" should be at once a warning and a comfort to the beginner, for he may be sure that the first few months of his studies are to be months of many trials, many discouragements, and perhaps many misgivings as to his fitness for this special work. Of course, good teaching will materially shorten and smooth this rougher part of his journey ; but even the best of teaching can do no more than this, and the main difficulties, the overcoming of his own early awkwardness, the learning of self-control, the acquirement of that invaluable

“knack” — not only in the handling of his instruments, but, as well, in the management of his patients—all these are only to be surmounted by a patient and persevering willingness to plod.

The average patient, regardless of age or sex, who comes or is brought to the specialist for the first time, is naturally more or less apprehensive. There is a prevailing density of ignorance about the nose and throat, not to speak of the ear, that is astonishing. Fear and superstition are the offspring of this ignorance, and as a result the new patient, after many months of procrastination, enters the physician's office with his mind filled with visions of saws and red-hot wires, and he cannot be easily persuaded that cure or even relief are to be obtained through other than surgical procedures. If your first examination of such people is to be both easy and thorough the early half of the visit had better be spent in quieting that nervous dread that will seriously hamper your investigation and possibly render it incomplete and unsatisfactory. There is nothing that facilitates the doctor's work so much as a willing and trustful co-operation on the part of the patient; and if during their first interview the former will study the temperamental peculiarities of the latter, and display some consideration for them, he will take a long stride toward winning his confidence and assistance. Some few minutes, therefore, spent in a quiet and unhurried chat concerning the object of the patient's visit and the events that have led to it will do much to place him at his ease; and if then the examination be undertaken with the same gentleness, and be prefaced with the assurance that no pain whatever is to be inflicted, the doctor will find that the most neurotic of patients will soon become one of the easiest to manage.

This little prelude upon the art of being gentle may be of itself entirely devoid of scientific value, but if heeded it may pave the way for the application of all the scientific knowledge that the physician may possess.

Let us imagine then that the patient is seated before us and that we are ready to illuminate the cavities that concern us. It is unfortunate, perhaps, but there can be no doubt that one of the greatest difficulties with which the beginner will have to contend occurs just here at the very outset of his work—I mean the management of his head-mirror and the control of the almost irresistible desire to move his own head. The light is placed to the patient's right, at about the level of his ear and ten or twelve inches distant from it. The more powerful the light happens to be the less closely need one observe these latter two details, the Welsbach light, for instance, permitting a great deal of latitude in this respect. Whatever the source of illumination may be, however, it is a fixed point, and it is to be constantly remembered that every movement of the examiner's head removes his mirror more or less from the direct path of the light rays and lessens the intensity of the illumination. The beginner will be greatly annoyed by the frequency with which he will need to be reminded of this fact. On taking his seat it is wise to exercise some care in getting the mirror properly adjusted. It is brought in front of the left eye, just out of reach of the lashes, and so placed that the perforation permits this eye to fully participate in the examination. It may be of some assistance at first to keep the right eye closed until the mirror is in correct position. Let me add here that it is of very great importance to cultivate an erect position of the body. Habitually bending forward or to one side or the other is not only extremely fatiguing, but is not particularly healthful. Having arranged all the preliminaries satisfactorily, what shall we inspect first? It is a matter of routine with me to begin my examination by asking the patient to open the mouth. Remembering that he is still a little timid and suspicious of your every movement, it is as well not to at once take up your tongue depressor and plunge it into his mouth, but rather to see all that you can before resorting to its use. Not infrequently we are able in our more composed patients, or in

those who have had any previous throat training, to obtain quite a comprehensive view without instrumental aid. It is a regrettable rule, however, that the moment the mouth is opened the tongue is either strongly protruded or is retracted, the base rising in the latter case until it reaches the uvula and velum, and so shuts off from our view much that it is essential for us to see. Sooner or later, therefore, we must introduce the tongue depressor. There is an art in doing this that cannot be too early learned. A word of explanation, particularly to children, that the instrument is nothing more than a variation of the domestic spoon, will not be wasted. The patient being asked to breathe quietly through the mouth and to keep the tip of the tongue inside of the teeth, the depressor, held in the left hand, is inserted rather slowly and placed very lightly upon the anterior portion of the tongue. [By those who are right-handed the tongue depressor and nasal speculum should always be taken in the left hand. The greater delicacy of the right is reserved for the probe, the applicator, and any instrument of operation.] If the broad "a" be now uttered with as nearly as possible complete relaxation of all the palatal and throat muscles the tongue will sink to the floor of the mouth, the depressor is advanced almost imperceptibly further back toward its base, and gentle forward and downward pressure is made. If early in the examination, or indeed at any time, there be exhibited the least rudeness, or impatience, or hurry, not only are the chances of complete success greatly diminished, but a mingled feeling of distrust and resentment is aroused in the patient's mind that cannot but render more difficult the subsequent inspection of the nose and larynx. With the most generous consideration for the patient, however, it is extremely important that the doctor himself be not timid or nervous. His hand should be perfectly steady, and just as much firmness as is consistent with gentleness should be employed. It probably becomes evident now that during his first few visits the patient is to be subjected to a course of training, but the system

adopted should be characterized by persuasion rather than by the application of force.

By means of alternate yielding and pressure then the rigid, resistant tongue has gradually relaxed and sunk out of the way, and all the faucial structures and the oropharynx are disclosed to the view. The many variations of color and conformation that are met with here will be separately described under the several disease headings. We need not delay, however, taking note of certain matters having a general as well as a local interest. It is always well to study the tongue for a few moments, to observe whether it is coated or merely altered in color; whether it is tremulous or thrust out with promptness and vigor; whether, in fact, it bears any evidence of gastro-intestinal or of general constitutional disturbance. As connected with such conditions we should also at this first sitting closely scrutinize the teeth; discover how many are missing and how many carious; anything indeed which may account for defective digestion, an offensive breath, or perhaps some cervical adenopathy. Finally it is advisable to search throughout the whole buccal cavity for anything that may suggest specific infection, recent or remote. The faucial tonsils, the velum and uvula, and the oropharynx will of course receive the special study that each may demand.

The examination of the mouth being complete we are ready to pass to that of the *nose*, and this is done quite irrespective of the fact that the patient's complaints and symptoms may point to disease elsewhere. The nose represents the very threshold of the respiratory as does the mouth that of the digestive tract, and a knowledge of its condition is essential to a clear understanding of whatever may be present in the lower portion of these tracts. Here again it is often worth while to commence the examination without any instrumental aid. If the fingers be placed upon the patient's forehead and the thumb beneath the tip of his nose, the latter may be raised, moved from one to the other side, and quite a view obtained of the vestibule and anterior portions of

the nasal cavities. In this way we may detect within the former the not infrequent eczema of this region, any unhealthy condition of the hair follicles, or the little fissures that occasionally mark the frontier between the skin of the vestibule and the mucous membrane of the fossa proper. The most important information given by this little manœuvre, however, is as to the position of the septal cartilage, whether there is any anterior deflection or a dislocation of it from its groove in the spinous process. The discovery in this way of such a deformity may avert the infliction of pain, and possibly the production of some hemorrhage, by the hasty or forcible introduction of the speculum. Having thus acquainted ourselves with the state of the anterior nares, we are ready to explore the deeper recesses of the nose. If the Gruber speculum be selected for this purpose, and it is skilfully used, the examination is likely to be thoroughly satisfactory to the doctor and not at all unpleasant to the patient. To exclude the vibrissæ from the field, and to make the view as comprehensive as possible, the speculum should penetrate to or a little beyond the inner margin of the vestibule. This is not easily accomplished in all patients, but, with a speculum of suitable size, it should always be attempted. If the vestibule be narrow and dry, or if there is a luxuriant growth of hair within it, the introduction of the speculum will be facilitated by anointing its tip with a little vaseline or glycerin. It should be held between the thumb and first finger, and when it has entered the vestibule the free fingers are utilized in grasping the nose and steadying the head. In entering the nostril the direction of the speculum should at first be upward and perhaps a little outward; and when it has reached the limit of movement in this direction its proximal end should be raised, carrying upward with it the tip of the nose, and the instrument then pushed directly backward into the nasal chamber. Having reached this point and thrown our light into the nasal fossa the tendency is to relax one's hold upon the speculum and to permit it to slip out a little. The

fingers that are astride of the nose should prevent this by drawing it forward over the instrument. (Fig. 15.) It will thus be seen that there is a combined pushing and pulling movement, the first by the thumb and index finger upon the speculum, and the latter by the fingers grasping the nose. The one possible accident that may occur through the rude or awkward manipulation of this instrument, but which, however, is common to almost all

FIG. 15.



Showing firm grasp of nose permitted by the use of the Gruber speculum.

specula, is the wounding of the mucous membrane covering the septal cartilage. If the beak of the instrument be turned toward instead of away from the septum, and if its advance be guided entirely by the sense of touch rather than by the constant illumination of its pathway, it is liable to come in contact with the mucous surface, to plough off some of the epithelial layer, and so produce some little pain and possibly a smart hemorrhage.

Although this may be easily checked, it is apt to alarm an already nervous patient and to somewhat delay one's progress. Having gotten the speculum well within the nasal chamber, the study of its contained structures is conducted by the examiner keeping his own head and, therefore, his light perfectly steady, and gaining any necessary alteration of position by moving the head of the patient. It is a good rule to observe some order as to the successive steps of the examination; to commence, for example, with the floor of the cavity, to look next at the lower and then at the middle turbinated bodies, and finally to turn the eyes to the septal surface and discover, if present, any of the many deformities to which it is addicted. At the same time, of course, the color of the mucous membrane is noted, and any alteration in the character or quantity of secretion. If it should happen that the turbinates are so swollen from any cause as to prevent a complete view of the fossæ they should be lightly brushed or sprayed with a 2 per cent. solution of cocaine. This is quite strong enough to reduce them considerably, but it is too weak to be of any danger even to that rare and much-dreaded individual the man with an idiosyncrasy.

Nasopharynx. The next step, the examination of the nasopharynx, is not an easy one. The postnasal space is apt to be a stumbling-block to the beginner, and will severely test his patience and self-control. It is now that the two hands are first used together, and the smooth and accurate co-ordination of their movements is not to be learned in a day or a week. Let the self-instructed student of this specialty be not discouraged if he fail to obtain a satisfactory view of the pharyngeal vault or of the posterior nares in his first dozen or even score of attempts. The fact that practice makes this comparatively easy should lead him to persevere and never to neglect an opportunity to use his postnasal mirror. The successive steps of the procedure should be studied and practised singly at first, and later in combination.

The essentials for a good view of this region are that the patient's head be held almost level ; that the tongue, particularly its base, be well depressed ; that the uvula and soft palate be completely relaxed and pendant ; and that respiration be quietly and steadily conducted through the nose. These conditions obtained, the examination possesses but few remaining difficulties. A word as to the mirror : Of course, the greater the size of this the more extensive the view given, but the greater will be the skill required for its introduction. Let the student then begin with a No. 2 and attempt the next two numbers as he becomes more proficient. To prevent the dimming of the mirror by the condensation upon it of the breath's moisture it must be slightly heated previous to its introduction. This is done by holding for a few moments its *glass* surface over the flame. If the metal backing be incautiously exposed in this way to the heat there will be some danger of melting its soldered attachment to the shaft. The warmth of the mirror is now tested by touching it to the hand, and the tongue being held well down out of the way by the depressor there is a clear path to the pharynx before it. I have learned, both from my own early attempts and my later instruction of others, that the greatest difficulty encountered in this examination is the proper management not of the mirror but of the left hand and the tongue depressor. It is particularly necessary that the base of the tongue be depressed as low and at the same time brought as far forward away from the pharyngeal wall as possible. If one is successful in doing this without producing gagging the subsequent placing of the mirror is a matter of trifling difficulty. I may say in passing that gagging is seldom provoked by *continuous* and *steady* pressure upon the tongue, however forcible it may be ; but it is the interrupted, jerky pressure that disturbs the throat and makes it rebellious. It is an excellent rule, I think, to delay the introduction of the mirror until the tongue has become perfectly quiet and submissive. If we do not wait for this, but insist upon hurrying the mirror into



position while the tongue is still combative and indisposed to sink beneath the blade of the depressor, we will but intensify its resistance by adding a fresh provocation. It is one thing, however, to get the tongue out of the way and quite another to keep it there. The moment the mirror is brought into action attention is diverted from the left hand, its firm, steady pressure upon the tongue is unconsciously relaxed, and the base of this member slips back from beneath the tip of the depressor, rises, and pushes the mirror up against the uvula or out of the pharynx altogether. Again and again this will happen until one's patience and temper are well-nigh exhausted. The only way to overcome this fault is

FIG. 16.



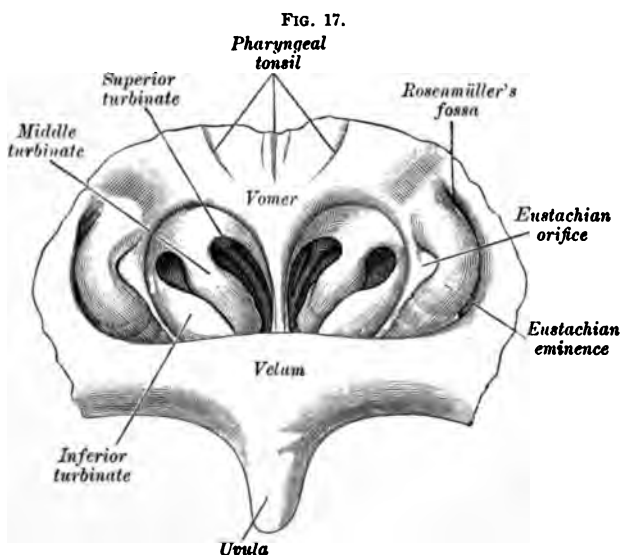
to make everything else subordinate at first to the mastering of this left hand. After a time its immobility will become almost automatic, and then time and temper will alike be conserved. With nothing to obstruct its entrance then it is a comparatively easy matter to carry the mirror back to the pharynx; but the manner of doing this skilfully needs practice. The instrument is held as shown in the illustration (Fig. 16), but there is no necessity for having any bend in its shaft.

It may be the natural impulse to adopt the shortest route and send it straight back to the throat in the middle line. If this be

done, however, the view will be interfered with and the mirror probably brought in contact with parts that are better avoided. It should be introduced, therefore, at the left corner of the mouth and passed obliquely backward and across the cavity to its right side. If the uvula be of troublesome length advantage may be taken of the interval that exists between it and the faucial pillar, and the edge of the mirror deftly slipped through this and carried back into the pharynx. If, however, the uvula be of no more than normal length the mirror need not be sent around it, but may be simply dipped beneath and beyond its tip. In many patients the moment that the mouth is opened or the tongue depressed the soft palate rises and applies itself to the wall of the pharynx, as though to protect the nasopharynx from some threatened injury. This of course shuts off our view of the cavity, and the obstruction is only to be removed by instructing the patient to breathe through the nose. Sometimes a little teaching is needed to enable him to do this while the mouth is widely opened. The student need scarcely be reminded that any contact of the glass surface of the mirror with the uvula will seriously diminish its reflecting power and probably necessitate its removal, cleansing, and reintroduction.

To pass the uvula successfully is to overcome one of the chief difficulties, but now must begin the education of the eye. Given a capacious throat and a large mirror that shows at once all the structures in their relative positions, the student will have little trouble in recognizing what he sees; but with these conditions reversed, and the ability to obtain only a fragmentary view of the parts, considerable training of the eye is needed to make the examination a satisfactory one. Attention may have to be called to the fact that although the examination may start with the mirror, as it should be, low in the throat and close to the pharyngeal wall, the almost invariable tendency on the part of the pupil is to presently raise it toward the region he is studying and to bring it nearer to his own eye, either of which movements will

tend to obliterate the image that he wants. The amount of motion permitted the mirror is exceedingly limited. Fixed we may say upon a pivot in the middle line, it should rock upon this from side to side or forward and back, successively bringing the different features of the cavity into view. The first of these that should be sought for, and almost always used as a point of departure in the search for others, is the border of the septum. (Fig. 17.) This is to be recognized as a vertical line, usually



Posterior rhinoscopic image. (SCHMIDT.)

thin and almost white, extending upward from the base of the uvula to the superior margin of the posterior nares. With this septal border in the centre of the mirror the nasal fossæ are to be seen on either side of it, with their turbinated bodies projecting inward from the outer walls toward the septum. Of these three bodies only the superior and middle are, as a rule, to be seen with any distinctness. If the uvula be short and the space between the velum and the pharyngeal wall wide then perhaps a good view of the lower turbinate may also be obtained; but it is usu-

ally only the upper portion of its posterior extremity that can be brought into view. Tilting now the mirror to one or the other side, the lower extremities of the Eustachian tubes enter the field and may be studied as to color and the presence of any catarrhal secretion. The surface of the mirror, turned upward instead of laterally, brings the vault and posterior wall of the pharynx to the eye, and here may be detected any retained mucus or growths of an adenoid, or neoplastic nature.

The Larynx. In preparing to examine the larynx certain preliminaries that may apparently be of little are really of great importance. Both patient and physician should sit erect, the adjustment of the light be carefully attended to, the mirror shown, and the manner of its use explained to the patient. He may also be told that he can facilitate your examination very materially by relaxing his throat muscles as completely as possible and by continuing to breathe naturally and without interruption. A moment's holding of the breath will do much to favor the occurrence of gagging, whereas it will be largely prevented if the attention be concentrated upon keeping the column of air in constant movement. This preparation of your patient for what is about to happen will greatly lessen the chances of those annoying interruptions due to his startled surprise upon feeling the touch of the mirror upon the soft palate or the wall of the pharynx.

In order that a good view of the larynx may be obtained it is necessary that the tongue be protruded from the mouth, since this movement will draw the epiglottis upward and forward and make the pharyngeal cavity much more spacious. The doctor must have a supply of what are called "tongue cloths," with which to take hold of this member and prevent its retraction. Small eight-inch napkins of linen or muslin cloth are best for this purpose. Few things denote the skilled laryngologist more than his manner of taking and holding the patient's tongue. Only the tip of it should be taken between the first finger and the thumb

of the left hand—the finger placed beneath it protecting it from injury by the lower incisor teeth—and it is held in the gentlest possible way without any suggestion of pulling upon it. Traction by the doctor prompts retraction by the patient, and in the struggle which ensues the latter invariably triumphs.

It is well then before introducing the mirror to hold the tongue lightly for a few moments until the patient is breathing quietly and all his throat muscles are in a state of repose. The mirror is now heated by holding its glass surface over the lamp flame for a moment, its warmth tested by touching its metal backing to the operator's hand, and it is then introduced within the mouth and carried back to the throat. The proper method of doing this merits a somewhat detailed description, and it will be well for the beginner to memorize each successive step of the examination and to give each its special study and separate practice until they all become smoothly blended and the manipulation is carried out as one movement. He who thrusts his mirror into the mouth with no other thought than that of reaching the throat as quickly as possible will have to consume a great deal of time in explaining to the patient how to control gagging, which is indeed no more than a muscular protest against the awkwardness or rudeness of the examiner. If the reader will study Fig. 18 he will learn from it several very important points. (The physician, by the way, in this illustration is evidently left-handed.)

It will be seen that the handle of the mirror is held as though it were a pen; that the examiner's hand is so far below the level of the mouth that it offers no obstruction to his view of the throat; also, that it is quite a distance to one side of the middle line, so that as the progress of the mirror toward the throat necessitates the gradual raising of the hand, it still will not encroach upon his line of vision. The figure shows, moreover, that the shaft of the mirror lies almost in the corner of the mouth, and that the mirror itself is not turned up on edge, but that its face,

just clearing the dorsum of the tongue, is held parallel to it. If, as it should do, it maintains this position with respect to the tongue as it is passed backward, the uvula and velum are not hidden from view as it approaches them, and the uvula will be the first structure with which it comes in contact.

FIG. 18.



Laryngeal mirror in position, displaying the laryngeal image. (COHEN.)

If the tongue be well down in the floor of the mouth and the tip of the uvula hanging clear of it the mirror may be dipped beneath the latter and then be lifted *upward* and *backward*, carrying the uvula and soft palate with it. Our object will be

to place the mirror as high and as far back as possible in the throat without producing gagging. Usually the first impulse of the student upon catching a glimpse of the larynx is to lower the mirror in the throat, as though the bringing of it nearer to the larynx would bring the laryngeal image nearer to his own eye. Though perhaps a natural mistake, this nevertheless is one to be studiously avoided, since the lower the position of the glass in the throat the less of the interior of the larynx will it reflect. Another point to be carefully cultivated by the student is perfect steadiness of the hand and mirror after the latter is in good place. The tremor of the hand due to nervousness will of course disappear with experience; but when this has been conquered the student must still beware of making any sudden or jerky movements in raising or depressing the handle of the mirror or in rocking it from side to side. Every alteration in the position of the glass should be made very slowly and be, as far as is possible, imperceptible to the patient. A final caution respecting the management of the mirror is this: When the student has manœuvred his glass into good position, and has obtained in it a distinct view of the intralaryngeal structures, he is apt to become so absorbed in his study of these that the tension of his right arm and hand is unconsciously relaxed, the restive soft palate pushes his mirror forward in the mouth, and the uvula is permitted to slip from above it and to hang down behind its posterior edge. The moment this accident occurs the view of the larynx is eclipsed by the reflection of the uvula passing down the centre of the mirror. It is only by at first dividing the attention equally between the mirror itself and what is seen in it that the habit of retaining the instrument in place is gradually acquired and becomes at last automatic. Some trouble will be encountered during one's early work in finding the proper angle at which to hold the mirror in order to obtain the best view of the larynx. The most frequent fault with beginners is to turn the face of the mirror too fully toward their own eyes, and by so

PLATE I.

MODIFIED FROM SCHNITZLER'S ATLAS.

Fig. 1. The normal larynx as it appears during inspiration.

Fig. 2. The normal larynx as it appears during phonation.

- a. Epiglottis.
- b. Left ventricular band.
- c. Left vocal cord.
- d. Eminence marking the site of the left cartilage of Wrisberg in the ary-epiglottic fold.
- e. Eminence marking the site of the left cartilage of Santorini and practically also that of the arytenoid cartilage in the ary-epiglottic fold.
- f. Interarytenoid space with a slight amount of the upper portion of the posterior wall of the larynx visible.
- g. Trachea with its rings.
- h. Right ventricle of the larynx.

Fig. 3. The larynx in a moderate attack of acute laryngitis.

Fig. 4. Early stage of tubercular laryngitis. Localized hyperæmia and thickening on the posterior portions of the vocal cords. Infiltration of the posterior wall of the larynx with tubercle formation. Pale, œdematous swelling of both ary-epiglottic folds obliterating the eminences of Wrisberg. Anæmia of the laryngeal mucous membrane.

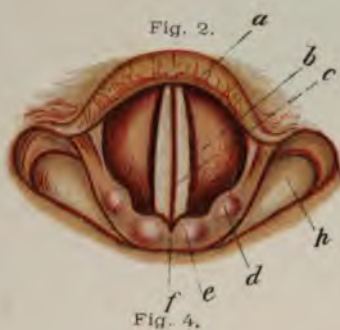
Fig. 5. Large, lobulated, tubercular infiltration on the posterior wall of the larynx. Commencing ulceration at the most prominent part of the growth.

Fig. 6. Tertiary syphilitic ulcer of the left ary-epiglottic fold and margins of the vocal cords. The right ary-epiglottic fold is the seat of a gumma that has begun to soften. The under portion of the epiglottis on the left side is superficially ulcerated from contact with the secretions of the ulcer on the ary-epiglottic folds.

Fig. 7. A papilloma attached by a broad base to the left vocal cord. It extends across the glottis and rests upon the right vocal cord. Owing to the weight of the tumor the action of the left crico-arytenoideus posticus is impaired and the left vocal cord is straighter and abducted less than the right one.

Fig. 8. An epithelioma involving both vocal cords. The left is merely infiltrated, while the right is ulcerated slightly. The deep red or purplish color of the passive hyperæmia should be contrasted with the appearance of the mucous membrane in other inflammatory conditions.

PLATE I.



doing to reflect merely the base of the tongue and perhaps the upper margin of the epiglottis. If on the other hand the glass be turned too straight downward the view will be proportionately cramped, and will be limited chiefly to the posterior wall of the pharynx and the arytenoid eminences. The happy medium between these two extremes being adopted, however, and a comprehensive view of the larynx procured, we are enabled to study the picture shown in Fig. 1, Plate I.

CHAPTER III.

ANATOMY AND PHYSIOLOGY OF THE NOSE AND NASOPHARYNX.

As the most prominent feature of the face, and one that is exposed to frequent injury and disfiguring external disease, we should be thoroughly familiar with the anatomy of the nose. Its external portion is built upon a framework of bone and cartilage, the former consisting of the nasal bones and the nasal processes of the superior maxillæ. The thickness and density of the *nasal bones* at their upper borders, where they are attached to the frontal bone and its nasal spine, give to the bridge of the nose a great degree of strength and make it highly protective to the internal structures. The lower borders flare outward and are much wider and thinner than the upper. At the union of the nasal bones in the middle line their borders project internally and form a so-called crest which connects them with the ethmoidal portion of the nasal septum. The outer borders of these bones are bevelled at the expense of their inner surface, and are supported upon the contiguous borders of the superior maxillæ. The dimensions of the nasal bones vary greatly in different skulls, and having but a thin covering of integument they give shape and character to the nose.

Nasal Processes. The nasal processes of the superior maxillary bones are thick triangular or pyramidal plates which project upward on each side of the nose to their sutural junction with the frontal bone. Their anterior borders are serrated for articulation with the nasal bones, the general configuration of the nose being largely dependent upon the dimensions of these processes and the manner in which the nasal bones are set upon them.

The internal face of each process is somewhat roughened and two distinct ridges are found upon it, the superior and inferior turbinated crests, these marking, respectively, the points of articulation with the middle and inferior turbinated bones.

The cartilaginous portion of the external nose is made up of the septal cartilage, the upper and lower lateral cartilages, and a varying number of smaller sesamoid cartilages. The cartilage of the septum forms the anterior portion of the partition between the two nasal fossæ. Below it rests upon the palatine processes of the superior maxillæ, posteriorly it projects backward between the vomer below and the vertical plate of the ethmoid above, and its upper and anterior border is attached to the crest of the nasal bones.

The lateral cartilages consist on either side of an upper triangular plate and a lower oval one, which together give shape and support to the alæ and tip of the nose. The upper lateral cartilages are attached above to the nasal bones and the adjacent nasal processes, to the septum in front, and below to the lower pair of cartilages. These latter are curved upon themselves, and are the principal elements in the formation of the boundaries of the external orifice of the nose. The meeting of the two in the middle line contributes to the formation of the septum columella or columna nasi. These cartilages, together with the little sesamoid nodules that lie posteriorly, are all connected with one another and with the bones by a tough, fibrous perichondrium. The elasticity of these cartilages not only preserves the size and shape of the nostrils, but permits that mobility so essential not only to facial expression, but to their expansion and contraction during respiration. The *skin* covering the root of the nose and the sides and greater part of the dorsum is thin and freely movable. That, however, upon the alæ and the tip is thick, very adherent to the subjacent tissues, and is remarkable for the number and size of its sebaceous follicles. Owing to the abundance of these latter this portion of the nose is frequently the seat of acne. Inflamma-

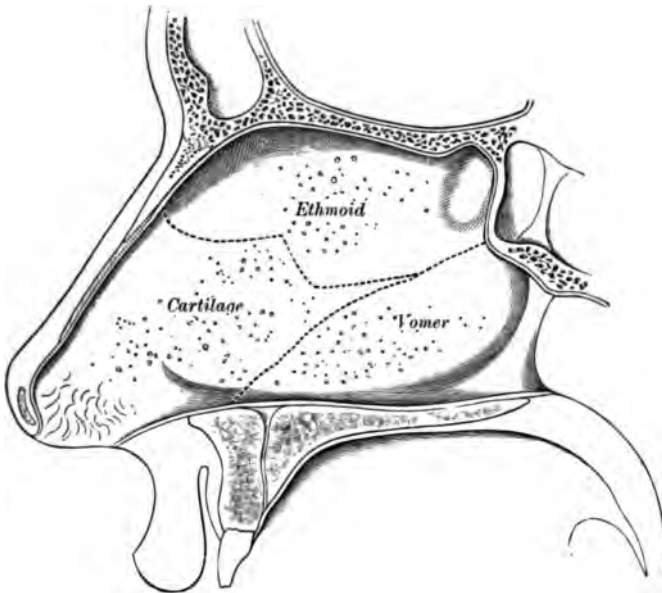
tion involving the lower portion of the nose is apt to be extremely painful, the density of the tissues and their very free blood-supply being accountable for the severe tension and the high degree of congestion. There is very little fat in the cellular tissue between the skin and the alar cartilages.

Muscles. The muscles that govern the shape and width of the nostrils are divided into two sets, the *dilators* and the *constrictors*. The former comprise the *dilator naris anterior*, the *dilator naris posterior*, the *pyramidalis nasi*, and the *levator labii superioris alæque nasi*. Only the first two of these are in action during ordinary respiration, the others being called upon only when some degree of dyspnoea demands their assistance. The *constrictors* are the *compressor nasi*, the two *compressors narium minor*, and the *depressor alæ nasi*. Functionally the dilators are much more active than the constrictors, and their greater importance is demonstrated when their function is suspended; for instance, by paralysis or profound narcosis the resulting collapse of the alæ necessitating mouth-breathing.

Nasal Fossæ. The nasal fossæ are two wedge-shaped cavities terminated in front by the nostrils or anterior nares and behind by the posterior nares, these latter being two oval-shaped openings by which the nasal chambers communicate with the nasopharynx. Each lateral cavity of the nose consists of two portions, the vestibule in front and the fossa proper immediately behind it. The vestibule is enclosed by the cartilaginous portion of the framework of the nose, and is limited posteriorly by a constriction or crescentic elevation which marks the threshold of the fossa. The lining of the vestibule is merely a continuation of the facial integument, and this, as it approaches the mucous membrane of the larger chamber behind, undergoes a gradual transformation into that tissue. The short, stiff hairs called *vibrissæ* are found growing more or less luxuriantly just within the outer margin of the nostril, and in addition to these this region presents numerous sebaceous follicles and vascular papillæ. The nasal

chamber is widest at its floor, which is approximately horizontal and is formed by the palate bones and by the palatine processes of the superior maxillæ. Arched from before backward the roof of the fossa is composed in front of the nasal bone, its median portion is the cribriform plate of the ethmoid, and it is completed posteriorly by the body of the sphenoid. This upper portion of the cavity is quite narrow, owing to the inward inclination of the

FIG. 19.



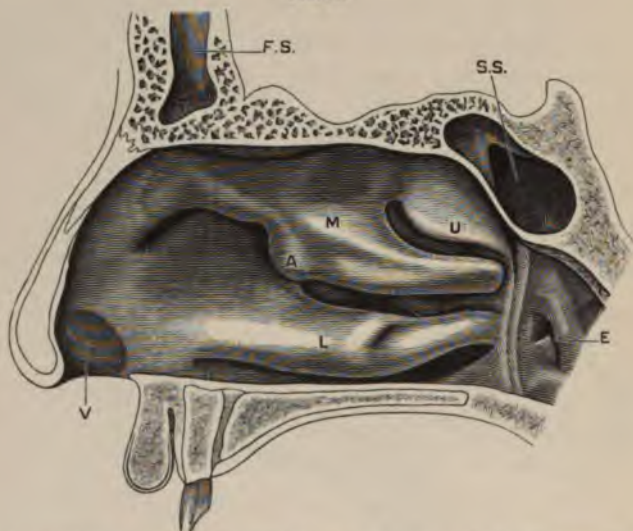
Antero-posterior section of the nose, showing the septum. (MERKEL.)

The lines of junction of the several pieces are indicated by the dotted lines. The vestibule and the vibrissæ are also pictured.

outer wall as it passes from below upward. The partition between the two fossæ, the septum, is formed in its posterior two-thirds by the vomer and the perpendicular plate of the ethmoid, and is, therefore, bony, while the anterior third is made up of the septal or triangular cartilage. (Fig. 19.) On the rare occasions when this structure is normal it is vertical. When its numerous deformities are considered in a later chapter

attention will be called to the sutural lines of its three component parts. The outer wall of the nasal chamber is made up of the superior maxillary, the lacrymal, the lateral mass of the ethmoid, the palate, and the sphenoidal bones, and projecting inward from it, running lengthwise and placed one above the other, are the three turbinated processes. (Fig. 20.) The inferior turbinate is the only one of them that is a distinct bone in itself. As

FIG. 20.



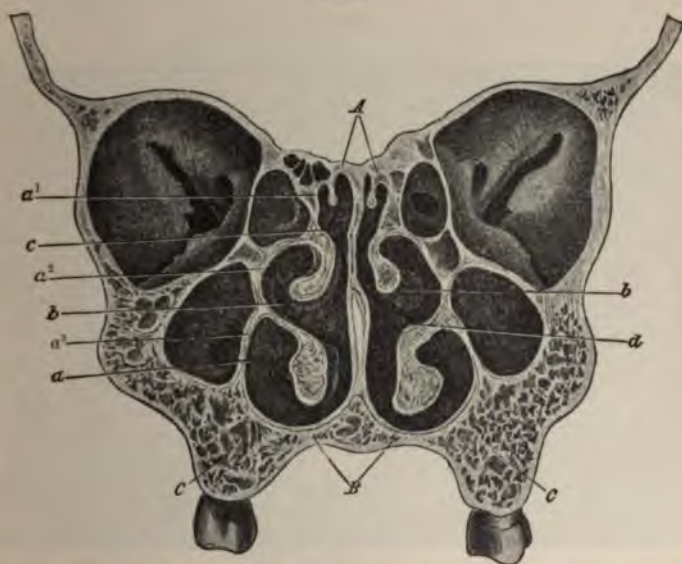
Antero-posterior section of the nose, showing the outer wall of the right nasal cavity. (ZUCKERKANDL.)

L. Inferior turbinate. M. Middle turbinate. A. Anterior end of middle turbinate. U. Superior turbinate. F. S. Frontal sinus. S. S. Sphenoidal sinus. E. Eustachian tube. V. Vestibule.

it passes inward from its attachment to the outer wall toward the septum its free border curves downward in scroll-like fashion and approaches more or less closely to the floor of the chamber. It is much the largest and most bulky of the three processes, and extends throughout the whole length of the nasal chamber from the anterior to the posterior nares. The space beneath the inferior turbinate is known as the inferior meatus, and it is on the concave surface of this body presenting toward the outer wall

that the nasolacrimal duct opens. (Fig. 21.) The middle turbinate is shorter than the lower, its anterior extremity not being placed as far forward as that of the inferior. It springs inward and downward from the lateral mass of the ethmoid, of which it is a portion; and its free lower border, curving well outward, forms a prominent feature in the anterior rhinoscopic view. Its concavity looks downward and somewhat forward, and forms the

FIG. 21.



Transverse section of the head, showing the relation of the structures within the nasal cavities. (ZUCKERKANDL.)

A. Roof of nose. B. Floor of nose. f. Outer wall. C. Superior maxilla. *a*¹. Superior meatus. *a*². Middle meatus. *a*³. Inferior meatus. *b*. Middle turbinate. *c*. Olfactory region. *d*. Respiratory region.

middle meatus. If a portion of this body be removed we can see upon the outer wall of the middle meatus a deep furrow, the *hiatus semilunaris*, extending from near the anterior extremity of the turbinate downward and backward. It is crescentic in shape, is directed in front toward the infundibulum, and overlying its anterior extremity is the *bullæ ethmoidalis*—a prominence corresponding to one or more ethmoidal spaces. The infundib-

ulum, without being a distinct canal, is the channel by which the frontal sinus communicates with the anterior ethmoidal cells, and is the common opening of these cavities into the middle meatus of the nose. Following the hiatus backward for a little distance we encounter the *ostium maxillare*, the opening through which the maxillary sinus communicates with the nose. The superior turbinate, the smallest of the three, springs also from the lateral mass of the ethmoid, although it looks as though it descended

FIG. 22.



Sharply-curved lower turbinates.

vertically from the under surface of the cribriform plate. Between its outer surface and the sloping external wall of the nose is the superior meatus, and into this open the sphenoidal sinus and the posterior ethmoidal cells.

The accessory cavities connected with each fossa of the nose are four in number, and are, naming them from before backward, the frontal, ethmoidal, maxillary, and sphenoidal sinuses. Whatever of special anatomical interest attaches to these cavities will be considered in connection with their diseases.

Nasal Mucous Membrane. The nasal mucous membrane extends from the curved constriction in front, marking the inner boundary of the vestibule, to the nasopharyngeal fold in the rear. It presents certain structural differences according as it is examined in one or the other of two distinct regions.

1. *Respiratory Region.* This comprises the lower and much the larger portion of the nasal chamber, its superior limit being

FIG. 23.



Lateral view of the turbinated bodies.

the upper portion of the middle turbinated body. In this region the surface of the membrane is covered by ciliated columnar epithelium, beneath which is a median layer containing vessels and nerves, and embedded in which are numerous glands, both mucous and serous. Between the acini occasional bundles of visceral muscle fibres are encountered, and other bundles of medullated mixed with non-medullated nerves can be traced in all directions at different levels. The deepest layer consists of

periosteum or perichondrium. In either case it is made up of highly vascular, closely packed masses of white fibres, whose connective-tissue cells undergo transition into either osteoblasts or cartilage cells.

From a physiological as well as pathological point of view the most important portion of the mucous membrane lining this respiratory region of the nose is that enveloping the lower turbinated body and a large portion of the middle turbinate. It presents in these places peculiarities of structure that are intimately related to the respiratory function of the nose, and alterations of which may lead to severe general as well as local disturbance. These structural peculiarities give to the tissue an erectile property that has been a matter of speculation and interest for many years. They consist of an exceedingly rich vascular supply and the presence of numerous large venous sinuses, to which latter the erectile property is due. These sinuses lie mostly in the deeper portion of the tissue, and form a loose, spongy network, with but little intervening connective tissue. When distended these walls are seen to be very thin and to contain, in addition to white fibres, a few elastic fibres mingled with numerous visceral muscle fibres, which run in all directions and interlace with one another between adjacent spaces. The lining of the sinuses is an endothelium similar to that of the veins which open directly into them.

When empty their walls present a corrugated appearance and are in close contact. The arterioles run from the periosteum directly toward the surface, and there break up into capillaries. These gradually merge into the radicle veins, which, in their turn, pursue a more or less direct downward course toward the venous sinuses, into which they immediately empty their contents.

With a clear comprehension of the arrangement of the vascular supply of these turbinated bodies—an arrangement which has gained for them the name of the turbinated corpora cavernosa—will be no mystery surrounding the mechanism of their

erection and collapse. Any cause which occasions an increased flow of blood to them will lead to the filling of the venous sinuses and the general tumefaction of the tissue in which they are contained. The moment this oversupply of blood is checked, however, the elastic and visceral muscle fibres in the walls of the sinuses contract, and they are promptly emptied. The rapid collapse that follows the application of cocaine or the suprarenal solution to the turbinated bodies proceeds from their contracting influence upon the arterioles. The supply of blood through these to the venous sinuses being checked the emptying of the latter and the shrinkage of the turbinates quickly follow.

2. *Olfactory Region.* This portion of the nasal fossa, as its name implies, corresponds with the distribution of the terminals of the olfactory nerve, and comprises the upper third of the septum, the superior turbinate, and the upper third of the middle turbinates. The cylinder epithelial cells in this region are non-ciliated, and their protoplasm contains a variable amount of pigment. Besides these there are the rod or olfactory cells of Schultze, and these are regarded as the special terminals of the olfactory nerve fibres. In the deep layers of the membrane is found quite an abundant distribution of glands. These are of a simple acino-tubular variety, and are separated by bundles of non-medullated nerves. They are known as Bowman's glands, and secrete a serous or albuminous fluid. Beneath this zone of glandular tissue there is a loose arrangement of connective-tissue fibres with arteries and veins, but nothing in the nature of erectile tissue.

Arteries. The arteries supplying the nasal fossæ are numerous. The roof, upper part of the septum, outer wall, and frontal sinus are supplied by branches from the ophthalmic. The sphenopalatine branches of the internal maxillary supply the septum, the turbinated bodies, and the meatuses. Finally the cartilage of the septum is supplied by the septal artery, a branch of the superior coronary. All these vessels form a finely meshed net-

work within the nose, extending throughout every portion of the lining mucous membrane. It is not surprising then that hemorrhage is so profuse during operations upon and from injuries to these parts.

The Nerves. The nerves of the nasal fossæ are of two kinds—those of special and those of common sensation. The filaments of the olfactory nerve enter the nose through the foramina in the cribriform plate, and are distributed throughout the upper or olfactory region of each fossa. Each nerve fibre is non-medullated and is accompanied by a perineural lymph sheath, by which the

FIG. 24.



Distribution of nerves in nasal passages (DALTON) : 1, olfactory bulb, with its nerves ; 2, nasal branch of the fifth pair ; 3, sphenopalatine ganglion (SEILER).

lymph spaces of the olfactory region are directly continuous with those of the subdural and subarachnoid spaces. The nerves of ordinary sensation supplying the nose come chiefly from the first two divisions of the fifth nerve and from the sphenopalatine or nasal ganglion. To the rhinologist an intimate knowledge of the distribution and connections of these nerves is of very great importance, since many neuralgias and headaches and affections of the eyes and of the facial integument are found associated with disturbances within the nose or its accessory cavities, and

are to be regarded as dependent upon them. Many respiratory troubles of a reflex nature—cough, asthma, and the like—are also often referable to some diseased condition occurring within the field of distribution of these common sensory nerves. Of the branches derived from the ophthalmic division of the fifth nerve the largest and most important is the *nasal*; and the fact that it supplies the anterior part of the nasal septum, the outer wall, and the floor of the nose will explain the more or less profuse lacrymation occurring during operations upon or irritation of these parts. It is the several branches of the superior maxillary nerve and those coming from the sphenopalatine ganglion, however, that supply much the greater portion of the nasal chambers.

The course and termination of each of these should be carefully followed and remembered, for upon a familiar acquaintance with them will depend the understanding of many of the reflex motor or sensory disturbances that may be more or less remote from the nose itself.

Physiology of the Nose. From having once been regarded merely as the seat of the special sense of smell the nose has, within comparatively recent years been accorded a place as an organ of physiological value very far in advance of this. Instead of being merely the seat of olfaction it is now recognized as being a portion of the respiratory tract scarcely second to any other in functional value. Moreover it is a highly important accessory organ of phonation, and the prominent part that it plays in this act finds immediate demonstration in the altered quality of the voice when any obstruction of its chambers occurs. Finally the lower or respiratory portion of the nasal chamber is to be regarded as the physiological continuation of the Eustachian tube, and as bearing, therefore, a very important relation to the organ of hearing. Any narrowing or other form of obstruction of this channel will mean a proportionate diminution in the freedom of aeration of the corresponding middle ear.

In order that the sense of smell shall be normally acute the odorous particles must have free access to the olfactory region of the nose, the lining mucous membrane must be sufficiently moist to dissolve these particles, and the nervous mechanism from terminal cell to brain must be intact.

In its rôle as an essential part of the respiratory tract the nose performs a threefold function. At its very threshold the vibrissæ remove from the air any coarser foreign particles that it may contain, while those small enough to pass this barrier are arrested by the moist adhesive surface of the mucous membrane within the fossæ. Besides being cleansed of its solid impurities in this way the air is still further fitted for an inoffensive passage through the succeeding portions of the tract by being heated to the temperature of the body and almost if not quite saturated with moisture. It has been demonstrated that however low the temperature of the air may be upon its entrance to the nose it is raised to "blood heat" in the fraction of a second that it takes it to pass through to the nasopharynx. In the same brief space of time sufficient moisture is added to even the driest air to bring it close to the dew-point. If we recall for a moment the arrangement of the vascular supply of the turbinated bodies—if we think what a torrent of blood may in an instant be poured into them through vasomotor agency, and of the greatly increased surface of mucous membrane that their distention exposes to the air—we will have no difficulty in understanding their enormous heat-radiating power and their proportionate ability to pour out an abundance of watery vapor. The average quantity of this latter that is given off in each twenty-four hours has been estimated at about 500 grammes.

The phonatory function of the nose consists in enriching the voice with resonance and color. It contributes very materially to its character, its individuality; and what is said of it in relation to the speaking voice may be repeated with added emphasis as to its influence upon the singing voice. Indeed, there can be

no singing voice—the sounds it makes are but little better than noises—when there is any degree of nasal obstruction. Further reference to this function of the nose will be made in considering certain of its diseases.

The Nasopharynx. The anatomical features of the nasopharynx that are of chief interest to us are the openings of the Eustachian tubes upon its lateral walls and the area of lymphoid tissue in the vault and upon the posterior wall of the cavity. The lower or cartilaginous portions of the Eustachian tubes stand out rather prominently beyond the surface of the pharyngeal wall, and can scarcely fail to be recognized when they enter the field of the mirror. They are situated slightly above the level of the floor of the nose. Immediately posterior to them are the fossæ of Rosenmüller, two crescentic depressions which may be either shallow or deep.

In the vault and upon the upper portion of the posterior wall of the nasopharynx there is a remarkable collection of lymphoid follicles and glands to which has been given the name of the *pharyngeal tonsil*.

The arrangement of these follicles and glands by no means follows a fixed rule. There is not necessarily any symmetry observed in their disposition. They are limited at the sides by the fossæ of Rosenmüller, and end above and in front upon the basilar process of the occipital bone. Not very remote from the centre of this mass of lymphoid tissue there is often found a small opening which leads into a pouch-like canal called the *pharyngeal bursa*. It varies greatly in its dimensions and may be altogether absent. The nasopharynx is lined with a columnar, ciliated epithelium directly continuous with that of the nasal fossæ and with that lining the Eustachian tubes. At the level of the soft palate, which marks the beginning of the oropharynx, the epithelium loses its ciliæ and becomes of the squamous type. The nasopharynx shares to a limited extent the functions of the nose. It is in such close anatomical connection with both the

nasal chambers and the ears that any pathological process within it will almost invariably lead to disturbance within, or an interference with the function of, these nearly related cavities. Respiration, audition, and vocal resonance may be very greatly modified by certain disease conditions affecting the nasopharynx.

CHAPTER IV.

ETIOLOGY, SEMEIOLOGY, MANAGEMENT, AND SPECIAL THERAPEUTICS.

A. GENERAL ETIOLOGY AND SEMEIOLOGY OF NASAL AND THROAT DISEASES.

UPON the threshold of the separate study of the various diseases of these regions let us take a preliminary look at them from the broad view-point of general medicine. Excluding those affections that are of a mechanical nature, such as congenital malformations or acquired deformities, there is scarcely one that has not some systemic factor more or less prominently concerned in its etiology. A knowledge of those most frequently to be reckoned with will not only further diagnostic completeness, but make of our therapeutics something more than an unvarying local routine of sprays, powders, and pigments. We will find that anæmia or plethora—the one or the other in varying degree—are very frequently in evidence; that temperamental traits form at times very conspicuous backgrounds; that inherited constitutional disease exerts a powerful influence upon the development and progress of many pathological conditions in the nose and throat, and that diathetic states are also intimately concerned with these processes. Finally the coexistence or the previous occurrence of disease of an organic or systemic nature will materially modify local phenomena. It goes without saying that any existent disease of the heart, the kidneys, the liver, or the gastrointestinal tract will be reflected with greater or less distinctness in the vascular supply, the glandular activity, and the general nutrition of the higher tracts of mucous membrane.

Without wishing to be regarded as an extremist in the matter there is not a shadow of doubt in my mind that the systemic condition most often to be found in association with nasal and throat diseases, and that is to be regarded as a if not the most active predisposing cause of them, is that known under the various names of lithæmia, the uric acid, the gouty, or the arthritic diathesis. Whether or not uric acid is the real offending agent in these cases I shall not stop to discuss, but with the general condition that has been commonly and for a long time attributed to it we are all of us sufficiently familiar. Whatever the systemic poison or poisons may be we may take it for granted, I think, that they have their origin in some perversion of nutrition, and it is most probably in the fundamental process of digestion that this has its commencement. Faulty digestion means faulty metabolism, and while this need not necessarily consist of an increased production of uric acid, yet it does imply the production of other toxic materials, which, if not promptly eliminated or neutralized by the protective forces of the organism, will proclaim their presence and power in a variety of ways. One of these ways, and the one with which we are more particularly concerned, is in the production of an abnormal susceptibility on the part of the mucous membrane of the upper air and digestive tracts to inflammations of a catarrhal nature. When this general toxæmic state exists only a very slight additional provocation is needed to occasion at some weak point in the respiratory or alimentary tracts an inflammatory outbreak. A moderate exposure to stress of weather, physical fatigue or emotional disturbance, or some trivial excess of a dietetic, alcoholic, or sexual nature, is sufficient to precipitate such an attack. To my mind, therefore, the pathogenesis of these disturbances is made up of nine-tenths of internal and only the one remaining tenth of external cause. If this belief is well-founded the therapeutic deduction to be drawn from it is quite obvious; and what is true of lithæmia and the gouty diathesis in their relations to nasal and throat disease is true, though

perhaps to a less extent, of the other systemic conditions that can influence local processes. The successful practitioner, therefore, will be he who apportions his treatment between the local and the general condition strictly in proportion to their relative activity.

Semeiology. Each added year of experience will lend increased eloquence to every symptom emanating from diseased conditions of the nose and throat. Each will gain in its special significance to the observer, and will lead him the more quickly to a correct diagnosis. It will be of use then as preliminary to a separate consideration of each disease and its phenomena to indulge in a general review of the symptoms most frequently present—those which are more or less common to the majority of these special diseases—and to familiarize ourselves somewhat with the several conditions upon which each may be dependent. Those more prominent are alterations of the voice, cough with its different varieties of sputum, disturbances of respiration and of deglutition, and disorders of smell, taste, and hearing.

VOICE. Any impurity of the primary or fundamental tone as it comes from the cords can of course only be occasioned by some abnormality of condition or function within the larynx itself. This may be secondary to disease elsewhere, but whether it be primary or secondary we must look to the larynx for the explanation of hoarseness or aphonia. Of course there are varying degrees of these; they may be constant or intermittent, or more marked at certain times than at others. Again, it may be only the singing and not the speaking voice that is affected, and the former perhaps in but one of its registers. Finally, though the speaking voice may be entirely lost, involuntary vocal acts, such as coughing and laughing, may be phonetic.

The quality or timbre of the voice is another matter, and may be affected by departures from the normal within any of the accessory cavities of phonation—the pharynx, mouth, or nose.

COUGH. The extremes met with in this symptom are very widely separated. The one may be scarcely more than a slight,

half-apologetic “hemming” or clearing of the throat, the other a violent, convulsive cough that empurples the face and threatens arterial rupture. Between these there are all grades of severity and innumerable peculiarities of phonetic quality.

SPUTUM. The sputum that usually accompanies cough varies in quantity, in character, and in the ease with which it is expelled, and each of these characteristics furnishes some testimony as to the point of origin of the altered secretion and the pathological condition that occasions it.

RESPIRATION. Disturbances of the normal respiratory act may be due to several local causes. New-growths in any portion of the upper air tract, acute œdema or chronic infiltration or thickening of the laryngeal tissues, abductor paralysis of the cords, foreign bodies—these are but a few of the local conditions that may interfere with natural breathing.

DEGLUTITION. Difficulty or pain in the act of swallowing is of very frequent occurrence in connection with throat diseases, and in certain grave cases the degree of obstruction may be so great or that of pain may be so intense as to make swallowing altogether impossible. The pain and swelling of a peritonsillitis, rheumatic pharyngitis, tuberculous or malignant ulceration of the epiglottis or larynx are the principal causes of painful swallowing or *odynphagia*. Mere difficulty in the act—*dysphagia*—may proceed from a pair of greatly hypertrophied tonsils, from paralysis or destruction of the velum palati, from neoplasms situated either within the fauces or pharynx, or, if without, occasioning sufficient pressure upon their walls to seriously narrow their calibre.

DISORDERS OF THE SPECIAL SENSES. The senses of smell, taste, and hearing may all be simultaneously impaired by certain diseases within the nose, such for instance as mucous polyps or necrosis of the middle turbinates. Keeness of taste is so dependent upon a normal sense of smell that anything that blunts the latter will have a similar effect upon the former. A sufficient

degree of nasal obstruction to necessitate mouth-breathing, the presence of adenoid growths that press upon and close the lower openings of the Eustachian tubes, or even a high degree of tonsillar hypertrophy, will in all probability lead sooner or later to middle-ear catarrh and gradual loss of hearing.

B. GENERAL MANAGEMENT AND SPECIAL THERAPEUTICS.

With a clear understanding that it will be necessary that our patient's general condition shall receive a very large share of our attention, measures that are general and wide-reaching in their effects must be studied and judiciously applied. Whatever information concerning our patient's business or social and domestic surroundings that can be of assistance to us should be obtained ; his modes of exercise and recreation, his great or little vices, should be ascertained and their effect upon his general health carefully computed ; and finally we should intimately acquaint ourselves with his habits of dress, of bathing, and more than all else of his diet. If there is any one thing to which we Americans may attribute the major part of our ills it is our dietetic follies. Without attempting to enumerate them singly we may content ourselves with two or three broad propositions, the first of these being that as a nation we eat too much ; the second, that our diet is too largely nitrogenous ; the third, that we worship the Goddess Hurry even at the table. I do not propose to support this bill of indictment by a mass of evidence or any extended argument. I only introduce it here as preliminary to the assertion that my readers will find that a very large proportion of the affections of the nose and throat that are brought to us for treatment are associated with subacute or chronic gastrointestinal disturbances and with the autotoxæmic state that proceeds from them. Mere questioning will establish the existence of the former ; examinations of the blood and urine of the latter.

This brief reference to systemic conditions and their management will at least suggest that an intimate and practical knowledge of general pathology and medicine is a prerequisite to success in any of the specialties. None of these latter can lead an independent existence, and he will be most successful in restoring to health the special organs or regions that he treats who first investigates the whole economy and makes it his primary object to bring it to a high standard of health. There is scarcely a disease of the upper air and digestive tracts whose relief or cure will not

FIG. 25.



The Davidson atomizers.

be materially hastened if, in association with its local treatment, measures are adopted by which the patient's general condition will be invigorated. The converse is equally true, and the specialist who limits his study and practice to the boundaries of some petty gland or cavity limits also his usefulness and discredits his profession.

It is our purpose and province here, however, to deal only with local therapeutics, and it is the methods by which remedies are applied to these regions that we shall principally discuss.

The apparatus that we most frequently use ourselves and that we place in the hands of the majority of our patients is the atomizer. Most of those found on sale in the apothecary shops are

apt to be worthless at the end of a few months' use, and patients complain very vigorously of the annoyance and expense to which they are subjected by such trash. For office use—though, of course, individual tastes may differ widely—a very satisfactory atomizer is the Davidson. (Fig. 25.) With ordinary care it ought to last almost a lifetime. In addition to the nasal tip, which throws a straight spray, there are two others, one giving a downward or laryngeal and the other an upward or nasopharyngeal spray. These latter two tips are of little practical value, however, since the horizontal portion of the atomizer tube is

FIG. 26.



The Burgess atomizer.

rather too short to reach as far back into the pharynx as would be necessary for their successful use. The best type of atomizer to order for the patient is probably the Burgess. (Fig. 26.) It is very durable, its spray is finely divided and abundant, and it is less expensive than the Davidson. A number of instrument makers offer atomizers very similar to this and no doubt equally as good. Improperly used, however, an atomizer is capable of doing almost as much harm as good, and we should make it a rule to give our patients the following instructions: The floor of the nose being horizontal, the head should be held almost level instead of

being tilted far back, and the tube of the atomizer also should conform to this position instead of being directed upward toward the frontal sinuses. Again, the spray should be sent straight back toward the nasopharynx. If it be directed to one or the other side the septum or the inferior turbinate will be apt to suffer from being struck too forcibly by the spray. Finally the tube must not be introduced within the nasal chamber, but is simply placed beneath the tip of the nose and then raised sufficiently to

FIG. 27.



Improper method of using atomizer.

bring it above the inner margin of the vestibule. (Fig. 28.) In certain cases, cleansing solutions may be introduced within the nose by means of what is known as the Bermingham douche (Fig. 30), and if more force should be necessary to secure thorough cleanliness of the cavities the rubber-ball syringe (Fig. 29), with a long and flexible rubber tip to it, may be substituted. In children also this latter may be used with comparative safety.

Another little instrument that may be used by intelligent parents for infants and very young children is the ordinary

FIG. 28.



Proper position of head and atomizer.

FIG. 29.



Rubber-ball syringe.

medicine dropper. The child lying upon its back a few drops from this may easily be introduced into the nasal fossæ. I refer

to the Thudicum douche, and all douches patterned after it, only to unreservedly condemn them. They accomplish no more than can be gained with far greater safety by the methods already described. The postnasal syringe is another device that I never have occasion to use in my office, and that I should never think of ordering for my patients.

The solution employed for cleansing the cavities of the nose and throat should be one of alkaline reaction whose specific gravity is as nearly as possible identical with that of the blood-serum. The time-honored Dobell's solution is still the model for

FIG. 30.



numerous more or less successful imitations. The formula probably most widely used is :

R. Sodii bicarb.,	
Sodii biborat.	ñā 3j.
Acid. carbolic. (cryst.)	gr. xv.
Glycerini	f 3j.
Aquæ	q. s. ft. f 3iv.—M.

S.—Add to a quart of water, and use in atomizer.

The alkalies in this combination render any inspissated mucus quickly soluble; the carbolic acid, in addition to a mildly antiseptic action, exerts a sedative effect, and the glycerin raises the specific gravity of the fluid to that of the blood-serum. A deviation of any degree from the proper density will render the solution irritating rather than bland and agreeable.

The tablets that are now manufactured in such large quantities are often a convenient substitute for the original Dobell's solu-

tion. Each physician or each manufacturing chemist varies his formula from all the others somewhat, but the resulting solutions all resemble one another so closely that one is not apt to be materially better or worse than the rest. There is one additional caution that had better be given to patients respecting the manner in which they shall use their solutions to get the greatest amount of benefit from them. The average untaught individual may spray the wash pretty fairly into his nasal fossæ, but the moment the spray ceases he drops his head forward and permits it all to run from his nose as quickly as it will. Any thickened mucus or other secretions fouling the fossæ are not to be softened and loosened unless the wash is retained for a few moments at least; and, moreover, the nasopharynx is almost invariably as greatly in need of washing as is the nose, and so every drop of the solution should be actively, though not too vigorously, drawn or sniffed back into this cavity and allowed to come down into the mouth. Then it may be expectorated with any mucus that may have accompanied it, the timid patient being assured, however, that should he inadvertently swallow any or all of it no harm will result. The method of spraying the fauces and throat through the open mouth is so obvious as to need no description, but attention may be called to the fact that if the atomizer tube is introduced well back toward the uvula and pharyngeal wall, gagging is much more likely to result than if it be halted just at the threshold of the oral cavity.

In addition to Dobell's and other formulæ that have for their object simply the cleansing and antiseptis of the nose and throat many others may be used in spray form that are intended to exert a distinctly remedial effect. These will be separately alluded to in considering the diseases that they assist in controlling.

In a number of cases inhalations of vaporized or nebulized remedies will be found of value. They are principally used in affections of the larynx and trachea. There are almost as many

inhalers in the market as there are atomizers, and like the latter a few are good, more are bad, and the majority are indifferent. To produce a decided impression upon a diseased mucous membrane an inhalation should be used two or three or possibly a half-dozen times in the twenty-four hours, and, therefore, it is a remedy for home rather than office use.

Pigments. Pigments are remedies held in solution or suspension by certain vehicles, and that are applied directly to the affected tissues by brush, cotton-wool, or some other form of applicator. Used in this way medicaments can be more strictly localized in their action than when used in spray form. There are probably a score of different forms of cotton carrier for the nose, ear, and throat, and it is only by trying a number of them that we are likely to find the one best adapted to our own hand. As a general rule, however, the lighter and more delicate the instrument the better.

Gargles. Gargles are now used with extreme rarity by throat specialists. There are so few people who know how to gargle effectively. By the ordinary method the solution rarely comes in contact with anything more than the base of the tongue, the anterior faucial pillars, perhaps, and a limited portion of the soft palate. Much greater thoroughness is obtained by gargling with the head thrown back and *the nose held*. If this be done the fluid invariably reaches and bathes the lateral and posterior walls of the pharynx. Even when properly performed, however, the muscular movements incident to the act are usually sufficiently disturbing to wholly neutralize what little good effect the remedies employed might otherwise have had; therefore gargles have been almost altogether supplanted by lozenges.

Lozenges. This form of local medication has many advantages, the most notable of which are their form, which makes them convenient to carry and easy to take; the slowness with which they dissolve, and, therefore, the prolonged contact that is obtained between the drug and the affected tissue; and, finally,

the comparative repose of the parts during the action of the remedy. According to its composition the lozenge may be stimulating or sedative, astringent, antiseptic, or expectorant.

Powders. Powders are used quite frequently in both the nose and the larynx. These have been objected to on the ground that they are unphysiological; but we are not dealing with normal tissues or conditions, and when approximately physiological materials like vapors or finely nebulized fluids fail of effect we are not only justified in using but are compelled to resort to methods that are somewhat more energetic than Nature's own. Powders are introduced by means of insufflators. From among the several

FIG. 31.



kinds that are made one had better be chosen and used constantly, to the exclusion of the others, in order that quickness and accuracy may be attained. For the larynx the one illustrated (Fig. 31) is probably the one most commonly employed. The skilful use of the laryngeal insufflator is by no means an easy matter, and the student may expect that it will be some time before he can deftly deposit his powders upon the cords or even get them within the larynx at all. There are many laryngologists who are content with holding the patient's tongue with their one hand while they introduce the insufflator back to the pharyngeal wall with the other, point it toward the larynx, and then, as the

patient utters "ah!" they compress the bulb and expel the powder. Given skilled hands on the part of the operator, and a quiet throat on that of the patient, this method of insufflating the larynx may be successful even perhaps in the majority of cases; but, nevertheless, there is always a want of certainty about it, and it is rather inelegant. Much the preferable way is to have the patient hold his tongue with the napkin, and then, with the laryngeal mirror in one hand and the insufflator in the other, to guide the charge of powder into the larynx, under your own eye and beyond the possibility of any doubt as to whether or not you have accurately placed it. Until the larynx becomes

FIG. 32.



Powder blowers with straight and curved tips.

more or less accustomed to the sudden impact of this foreign substance there is apt to be considerable glottic spasm that may alarm the young laryngologist quite as much as the patient himself; but if the latter is told in advance of what is likely to happen, and is instructed at the same time to hold his breath until the spasm relaxes, it will be but a few moments before the little commotion will have subsided.

Although this same type of insufflator may be used for the nose, a better one is that illustrated in Fig. 32. The long, slender tube of this instrument makes it possible to carry the powder directly to the spot or limited area that needs medication, instead of spreading it over an expanse of possibly healthy tissue.

The Galvanocautery. There will be no better time or place than the present to call your attention not to the use of caustics in general, but to that of the galvanocautery in particular. Probably nothing since its establishment has so seriously threatened the good repute of rhinology as a special branch of practice as has the indiscriminate use—the almost criminal abuse—of this form of cautery. There can be no question as to its value when judiciously used, but for a number of years following its introduction it was employed in the most ignorant and reckless way for all sorts and conditions of nasal ills, and largely supplanted for a time the more rational methods of treatment. Every practitioner who chose, whether he had any special knowledge of the nose and its important functions or not, provided himself with a cautery battery, and considered himself amply equipped to conquer every known nasal malady. For some years we heard from the lips of laity and profession alike constant references to “electric knives,” “hot wires,” “burning out noses,” and a number of other equally blood-curdling expressions. Pathological conditions and physiological functions were wholly disregarded, and the slightest narrowing of the nasal fossæ, whether acute or chronic, temporary or persistent, became at once the excuse and justification for a prompt resort to this destructive agent. It is a lamentable and humiliating fact that the harm accomplished by it during its period of popularity, brief as it was, was vastly in excess of the good. If, therefore, throughout the following pages I shall occasionally advise its employment the reader will not be surprised if my recommendation be coupled with a warning. Unless one proposes to devote himself to rhinolaryngological practice as a specialty I scarcely think it necessary that he go to the expense of purchasing a cautery battery or of having the electric light current introduced into his office from the street. The galvanocautery and electric illumination of the various cavities of the nose and throat are at times no doubt of considerable assistance; but it

is extremely seldom if ever that these things are really essential to successful diagnosis or treatment. They are luxuries, not necessities, and the longer one pursues this work without them the more likely and able will he be to dispense with them altogether. This chapter would not be complete without some reference to the general use of *cocaine* in rhinology and laryngology. This drug provides another instance of a most valuable remedy being brought under suspicion and subjected to much abuse solely through the ignorance or folly of those who have misused it. It is poor logic to condemn a drug, and to urge that some other of less potency be used in its stead, simply because carelessness or inexperience in its use have led to serious results. It is so easy and withal such a temptation to attribute to some exceptional or anomalous exhibition of toxicity on the part of the drug the evil perhaps the fatal effects of one's own incautionness. By this time, however, we should all of us be pretty well informed concerning the toxic power of cocaine, and being both forewarned and forearmed by this knowledge we have but to estimate the vital power of the patient to obtain a fairly accurate idea of the amount of the drug that we can use with safety. If we are careful to do this in all cases, and to keep well within the limit that our judgment has fixed, we will not have to resort to individual idiosyncrasies and erratic manifestations of energy on the part of the drug to explain unfortunate accidents, for none will happen to us. Probably the most prevalent blunder connected with cocaine has been its use in solutions of too great strength. In the vast majority of cases a 4 per cent. solution will effect all the anæsthesia that may be necessary, and contract sufficiently any swelling of the erectile tissues. In operative cases of some severity that are apt to require a longer time than usual for their completion a 6 or perhaps an 8 per cent. solution may be used; but this should be the limit, and rather than employ any higher percentage I should advise a general anæsthetic. There are, however, text-books of comparatively recent

appearance whose authors write with easy confidence about 10 and 20 per cent. solutions of cocaine, and these are the experts who also do not hesitate to place 4 per cent. strengths in the hands of those of their patients who happen to be suffering from hay fever or even an ordinary coryza.

Another imprudence that should be avoided as far as possible is the use of cocaine solutions in spray form. Even if they are weak it is not easy to measure the quantity used, and the fact that it is distributed over an extensive surface implies its rapid and almost complete absorption. It is equally efficient and infinitely more safe to apply the solution directly and only to the area of tissue needing it by means of the applicator and its tuft of cotton.

The reader will gather from these remarks about cocaine that while I appreciate to the full its power as a poison I am equally cognizant that this power is quite controllable, that there is nothing treacherous about it, and that with proper care there is not the least reason to be afraid of it. The drug is so very far superior to the several substitutes that have been proposed for it, and my own experience with it since the time of its introduction has been so entirely free from even the suspicion of an accident, that I count myself among its warmest friends.

CHAPTER V.

INFLAMMATIONS OF THE NASAL MUCOUS MEMBRANE.

THE ordinary characteristics of inflammation of the mucous membrane are modified somewhat within the nose by the special type of vascular arrangement that we find here, as well as by the fact that an equal amount of swelling and hypersecretion within the narrow nasal fossæ occasions a greater proportionate amount of symptomatic disturbance.

ACUTE RHINITIS.

Catarrhal. Fibrinous or Croupous. Infective or Toxic.

Etiology. If there were such a thing as a perfectly healthy man—one with absolutely sound organs and tissues—it is probable that an exposure sufficient to occasion a chill of moderate severity would be followed by nothing more than some transient vascular disturbance with elevation of temperature, and that this would continue only so long as would be sufficient for the heart and vasomotor centres to regain their equilibrium and reassert their control. In the imperfect man of the present age, however, there are so many spots of low vitality, of feeble resistance, that a chill such as that just mentioned will almost invariably be followed by some localized congestion or inflammation. The rarity of the normal nose largely accounts for the frequency of the “cold in the head,” which is but another way of saying that one very active, predisposing cause of acute catarrhal rhinitis is some pre-existing abnormality within the nose. This may be one of a dozen or more conditions, all widely differing from one another, perhaps, yet all having in common more or less hyperæmia and

hypersensibility of the mucous membrane. Associated with most of them, also, and more active in their causation, no doubt, is that dyscrasia the chief ingredient of which is supposed to be uric acid. At the risk of repeating something of what I have already said in a previous chapter, let me be a little more explicit as to the etiological influence of this uric-acid dyscrasia. I use the term to indicate a condition the anatomical and chemical nature of which has not yet been clearly demonstrated, but which we know to be a general autotoxæmia. Of the patients who come to us with a simple acute rhinitis there are comparatively few who appeal for relief simply from this particular coryza from which they happen to be suffering at the time of their visit. Almost all of them complain of the frequent repetition of these attacks, of the fact that they have no sooner recovered from one than they develop another. They assert that they are most annoyingly sensitive to the gentlest draughts, to the most trifling alterations of temperature or atmospheric moisture. They sneeze, and their noses become "stuffy" upon the slightest provocation; and it is to be delivered from this seemingly constitutional tendency to take cold that they present themselves at our offices. If we limit our examination of these people to their noses and throats, under the supposition that we will find in these regions all the predisposing factors of their trouble, we will be apt to entirely overlook that one which is of greatest importance. The chronic nasal condition, however bad it may be, is of but slight etiological significance in comparison to certain features of the patient's general condition. If then we examine such patients as carefully and thoroughly as though they had come to us for the cure of a chronic nephritis instead of a simple acute rhinitis, what are we apt to find that will enlighten us as to the reasons for their frequently recurring attacks? I have no hesitation in asserting that in ninety-nine of every hundred we will unravel a state of affairs which, to put it in a nutshell, is this—they eat too much and exercise too little.

The fact that almost all of them will tell us that they are "very light eaters," that they "eat scarcely anything," and other more or less indignant denials of the suggestion that they eat to excess, affects my opinion not at all. Their consumption of food at the table is out of all proportion to their combustion of it at work or at play. They are indolent people; they are soft; they are overweight; their complexions are not what they ought to be; and in all probability they are constipated. The oxidative processes in such individuals are inevitably languid and incomplete, and we have the blood, therefore, tainted with a number of products of suboxidation of which uric acid is the type. The urine is invariably altered more or less both in quantity and quality. It is scanty, high-colored, of high specific gravity, and on standing at a slightly lowered temperature it deposits a bulky sediment of mixed urates, or uric acid, or both. Not infrequently, also, we find in it some crystals of oxalate of lime. In a word, these people are the subjects of what for want of a better term we call lithæmia; and it is to this general condition much more than to any local abnormality within the nose itself that their repeated attacks of coryza are due. Coryzas in these patients, therefore, are to be regarded as neither more nor less than nasal signals of systemic poisoning.

Struma, tubercle, and syphilis also exert an influence in making one hypersensitive to exposure or abrupt changes of temperature, and there is abundant proof that overwork, be it mental or physical, or lowered vitality due to emotional strain or vicious excess of any kind, increases the individual's susceptibility to this disease.

It is scarcely necessary to occupy space with a rehearsal of the immediate or exciting causes of simple catarrhal rhinitis. Draughts, chilled feet, and too rapid cooling when overheated are so common and familiar as to need but passing reference.

Symptomatology. This also may be quickly disposed of, for repeated personal experience of the disease has doubtless

impressed upon each of us its usual course and stages. The preliminary chill or "creepy" sensation shortly follows the exposure, and then appears a trifling rise of temperature with perhaps some little muscular aching. Almost simultaneously the implication of the nose is announced by sensations of heat and tingling, and a little later by the occurrence of vigorous sneezing. A thin, serous discharge accompanies this latter symptom, the erectile tissue of the turbinates swells to the capacity of the fossæ, and all the physiological functions of the nose are seriously crippled. The senses of smell and taste are noticeably impaired, nasal respiration ceases, and the change in the character of the voice at once attracts attention. Added to these symptoms there may be some dull frontal headache, due either to actual extension of the inflammatory swelling into the frontal sinuses or to obstruction of their outlets. Facial pain would indicate a similar involvement of the maxillary sinuses, while dulness of hearing and tinnitus would arise from Eustachian obstruction. Three or four days' continuance of this condition will bring the attack to its stage of decline. The discharge, lessening in quantity, gradually changes from a seropurulent to a mucopurulent character. It is now apt to be thick and tenacious and is only to be expelled by vigorous and persistent blowing of the nose. The turbinate engorgement gradually subsides, and under ordinary circumstances the disease will have quite disappeared at the end of a week. In those cases, however, where the predisposing systemic conditions are particularly well-marked, or where the accessory sinuses have been more deeply involved than usual, convalescence may be protracted for several weeks.

Pathology. This may be studied in three stages: The first, that of invasion, being characterized by vascular engorgement and arrest of secretion; the second, the height of the attack, by exudation from the vessels of serum and white blood-corpuscles which infiltrate the mucosa, as well as by greatly increased

epithelial proliferation; and the third, that of decline, by re-establishment of the function of the mucous glands, which, by adding their secretion to the discharge, increase its thickness and opacity.

Diagnosis. What may seem a matter of perfect simplicity to the experienced specialist may be fraught with difficulty to the beginner. For the former, a question or two and a glance at the intranasal condition will probably suffice to establish his diagnosis; but to avoid blunders the novice must be more deliberate in his examination. It is unusual for the victim of a coryza to visit his physician before the latter part of the first or the beginning of the second stage. The history will include one of the several forms of exposure, the quickly following nasal discomfort, and the rapid development of the disease. Many previous attacks will also be recalled if the patient's memory be invoked. Anterior rhinoscopy will reveal the turgescient turbinates, middle as well as inferior, their color a bright or a dull crimson, and their sloping surfaces glistening with the thin serous secretion that marks this period of the disease. It should not be difficult to exclude iodism or the rhinitis of syphilis; the absence of any noticeable constitutional disturbance will negative the invasion of one of the infectious fevers, and hay fever will not be suspected when we are familiar with its objective appearance.

Treatment. From what has been said under the caption of Etiology the reader will not be surprised if I emphasize the value of general treatment and disparage that of local treatment. The former should always take precedence of and dominate the latter, and there is rarely a sufferer from this disease entering my office who does not take a laxative of some kind before any attempt at local palliation is made. Not a moment should be lost in beginning that internal scouring which will both alleviate and abbreviate the attack. The blood current must be cleansed of those impurities that have made the nasal mucous membrane an easy mark for acute inflammation, this inflammation being the method by which the membrane makes an effort to eliminate

these irritating materials. To accomplish this free catharsis should be one of the first measures adopted. A triturate containing a half-grain of calomel and a twelfth of podophyllin, taken every half-hour, will usually quickly and thoroughly unload the bowels, and this may be supplemented by a wine-glassful of Apenta, Hunyadi, or Friedrichshall water every morning on rising until the attack terminates. Instead of immediately sending the patient home to take a hot foot-bath, a hot spirituous drink, and to wrap himself up in blankets, it is infinitely better to have him spend an hour or two in the most vigorous sort of exercise. An eight or a ten mile ride on a hard-mouthed, hard-trotting horse; a twenty minutes' set-to with some clever boxer; a bout with the foils, or an hour spent in his own room with dumb-bells, clubs, or chest-weights will do more to palliate and shorten his period of suffering than all the quinine, and Dover's powder, and Turkish baths that ever were prescribed. And this exercise should be repeated several times daily, if possible, until the rhinitis has entirely disappeared.

The quickened capillary circulation and vigorous action of the sweat glands that accompany hard exercise are incomparably more beneficial than the merely passive leakage that follows the use of diaphoretic drugs. If in addition to this an abundance of water is drunk and the supply of food is greatly reduced—almost stopped in fact—we may look for an amelioration of all the coryza symptoms in a much shorter time than if our main reliance is vested in the quinine, belladonna, and opium combinations that have had too prolonged a vogue. With the exception of the enforced mouth-breathing, the most annoying symptom of the disease is probably the profuse and often acrid rhinorrhœa. There are rare occasions when it is imperative that this be restrained. Professional voice users—actors, singers, public speakers—cannot go on the stage with so continuous a discharge; and there are certain social functions, such as dinners and receptions, at which one is scarcely presentable during the

active period of this disease. For such emergencies we may be compelled to give our patient one of those formulæ whose *routine* use I have just opposed. That which I have found the most effective is made by several of the manufacturing chemists under the name of "coryza tablets."

R. Quininae sulphat.,
 Ammon. chlorid.,
 Camphoræ ʒss gr. ss.
 Ex. opii,
 Ex. belladon. fol.,
 Ex. aconit. rad. ʒss gr. $\frac{1}{10}$.—M.
 Ft. in a tablet.

One of these may be given at hourly intervals until the patient is conscious of the belladonna dryness in the throat. Secretions from the nasal mucous membrane will be arrested at the same time, but as soon as the occasion that demanded the tablet has passed it should be discontinued. A tablet like this should never be given when a catarrhal rhinitis has pretty well entered the second stage; that is, when the nasal discharge has begun to thicken somewhat and acquire a mucoid or mucopurulent character. Administered at so late an hour, the belladonna and opium would only increase the patient's discomfort by increasing the consistence of the nasal secretion, and so rendering it the more difficult of expulsion.

LOCAL TREATMENT. Judicious local treatment is capable of reducing very materially the discomforts of an acute rhinitis. The patient himself is given the Dobell or some similar solution, and told to use it in an atomizer several times daily. The following plan of treatment carried out by the physician, and modified more or less as occasion may demand, will usually, I think, be found quite effective and satisfactory. Upon looking into the nasal fossæ through the speculum we will see little more than the engorged and tumefied anterior extremities of the lower turbinates. They are a bright crimson in color, and if we touch them ever so lightly with a probe we will find that they are intensely hyper-

æsthetic. For the double purpose of blunting somewhat this hyperæsthesia, and of shrinking the swollen turbinates so that the upper and posterior portions of the cavities can be seen and thoroughly cleansed, a very little of a 2 per cent. solution of cocaine—scarcely more than what would amount to two or three drops on each side—is sprayed into the nose. Within a minute the lower turbinates will probably have contracted sufficiently to expose the middle ones above them, and these also may then be just moistened with the same weak cocaine solution. After the lapse of another minute we are ready for the Dobell solution, and with this the nose is sprayed, possibly several times, until both the nasal fossæ and the postnasal space have been well flushed. To accentuate and prolong the contractile effect of the cocaine upon the arterioles of the mucous membrane a 1 to 4000 solution of adrenalin chloride may now be used. This is to be introduced either by atomization or by means of the applicator with its tuft of cotton. Within a few minutes after this has been applied the previously swollen and hyperæmic tissues will have become shrunken and almost bloodless, and we may now terminate the local treatment by the application of one of two or three different preparations. One of these is :

R. Camphor,
 Menthol ãñ gr. x.
 Benzoinol fl ʒi.—M.

This is introduced upon the cotton-carrier, the nasal mucous membrane being gently brushed over with it, and it is then carried back to the nasopharynx and the pharyngeal wall well mopped with it. In case the Eustachian tubes participate in the inflammation to any extent, as would be indicated by a full sensation in the ears, some lessened acuteness of hearing, and perhaps a little tinnitus, the tip of the applicator may be bent to the curve of a Eustachian catheter and the solution carried into the openings of the tubes.

In place of this combination we may use in a similar manner an ointment of this composition :

R. Cocaine hydrochlorat.,
 Menthol aa gr. xxiv.
 Vaseline alb. 3ss.—M.

The menthol contained in these preparations, in addition to its slightly contractile effect upon the vessels, leaves a sensation of coolness within the nose which is very grateful to the patient, and the vaseline in one and the benzoinol in the other both act as protectives to the inflamed and oversensitive tissue.

Finally, instead of either of the foregoing, we may insufflate one of the stearate of zinc powders, and the one containing menthol is probably the pleasantest of them. The insufflator shown in Fig. 32 is an excellent one for this purpose. The use of any powder, however, should be limited to the serous stage of the attack. The patient should return for a daily repetition of this treatment and it may undergo some change in its details as the different stages of the disease succeed one another. For instance, early in the third stage, when the subsiding inflammation is leaving the mucous membrane relaxed and shedding its epithelium much more rapidly than it should, a one to three solution of the distilled extract of hamamelis will prove an excellent mildly astringent spray. It may be a little pungent when first used, but the after-effect is rather refreshing as well as curative. If in spite of two or three days' use of this the rhinitis shows a disposition to linger in a subacute form, if the turbinates are a little slow in returning to their normal size, and if the mucopurulent secretion remain persistently thick and excessive, the witch-hazel may be supplanted by the following solution :

R. Acid. carbolic. (cryst.) gr. xviii.
 Tr. iodin. comp. f3j.
 Glycerini f3jss.
 Aq. dest. f3ij.—M.

Place in a water-bath of 100° in a tightly corked bottle until the solution becomes colorless ; then filter.

This, known as "Boulton's solution," is an extremely useful one, not only in the late stage of acute nasal catarrh but also in commencing the treatment of the simple chronic form. It is of syrupy consistence and may be used either in the atomizer or upon the applicator. It is even a little more pungent than the hamamelis, and it is not unusual for it to occasion a few minutes of sneezing and an increased discharge that is much more serous in character. One or two applications of this are ordinarily sufficient to stimulate the normal reparative processes in the tissues and to remove the last traces of the attack.

In the absence of complications this plan of treatment should minimize the patient's discomfort and bring the attack to a close within a week. I think it useless to introduce here a long list of formulæ for snuffs and inhalations that are of little or no value. In those patients, however, in whom the gouty or rheumatic diathesis is distinctly marked I invariably add the salicylates to the general treatment, and am confident that they lessen the severity of the attack and any tendency to the implication of neighboring cavities. A very satisfactory combination that may be given in capsule or compressed tablet is—

R.	Sodii salicylat.	.	.	.	.	.	.	gr. vijss.
	Sodii bicarb.	.	.	.	.	.	.	gr. ijss.
	Vin. colchici sem.	.	.	.	.	.	.	℥v.—M.

One of these, about an hour after each meal, is generally sufficient to neutralize the influence of the diathetic factor, or rather perhaps to increase the solubility and hasten the elimination of those impurities whose influence in precipitating the attack has been dwelt upon.

Fibrinous, Croupous, or Diphtheritic Rhinitis.

The fact that primary nasal diphtheria and a non-diphtheritic pseudomembranous rhinitis are both of occasional though rare occurrence makes it important to call attention to these two con-

ditions and to indicate the means by which they may be distinguished.

It is not infrequent for the application of the galvanocautery to the turbinated bodies to be followed by an exudative inflammation and the appearance of a membrane limited perhaps to the site of the wound, but extending possibly throughout the whole fossa. This is an instance of a purely croupous inflammation of traumatic origin, and it is quite distinct from the idiopathic pseudomembranous rhinitis that now concerns us and that can be referred to no such cause. This latter is not restricted to any one period of life, but it is in children that it most often occurs. For some days or even weeks before the discovery of the local lesion the child may be rather fretful during the day and restless at night. Beyond this, however, there may be nothing but the nasal discharge that is at all noticeable. Systemic disturbance is entirely wanting; there is, as a rule, no neighboring adenopathy, and the child's appetite and general vitality are but little impaired. Finally, however, the persistence of the discharge from the nose may attract attention and lead to an examination. The result of this is the discovery of a whitish, fibrinous exudate within the nasal fossæ, generally limited to or at least more abundant in one than in the other. It seems to be merely imposed upon the surface of the mucous membrane, and fragments can usually be removed with the production of but trifling bleeding. Bacteriological examination of the membrane reveals the presence of cocci only. *Staphylococcus pyogenes aureus* is the one in greatest force, and perhaps associated with it a much smaller number of streptococci are found. Other pathogenic germs than these are usually entirely wanting. It goes without saying that the disease is non-infectious.

While there can be no doubt that primary nasal diphtheria is relatively extremely rare, yet I am confident that it is more frequent than is generally supposed. Within the past six years I have seen seven cases at the hospital of the University of Penn-

sylvania—cases that gave the Löffler bacillus in almost pure culture—and I have reason to suspect that among several other cases that were recorded as simple fibrinous rhinitis there were one or two of genuine diphtheria. Nasal diphtheria that is secondary, that is occasioned by auto-infection or by simple extension from below, is apt to be highly malignant, and the severity of the systemic disturbance quite overshadows in importance that of the nose. In the primary form of the disease, however, there may be a remarkable mildness of systemic involvement, at least in the earlier days of its existence. The local symptoms are more pronounced than in simple fibrinous rhinitis, the nasal discharge being more profuse and sufficiently irritating to excoriate the upper lip. It is apt to be somewhat fetid also, and there is almost always some swelling and tenderness of the cervical lymphatic glands. In degree, however, this glandular implication is not to compare to that accompanying the faucial and pharyngeal form of the disease. The pseudomembrane is apt to be rather deeper in color and more dense than that of the simple croupous inflammation, requires more force for its removal, and leaves beneath it a smartly bleeding and more or less deeply eroded mucous membrane. With the continuance of the disease the child gradually becomes pale and languid, and it is only then perhaps that the parents or even the family physician may suspect something more serious than an obstinate cold and have the specialist make a more thorough investigation. Culture tests of the exudate invariably give the Löffler bacillus, but this may be of varying degrees of virulence. In direct proportion of course to this quality of the germ will be its high or low power of infection. Albuminuria may or may not be present, and local palsies may or may not follow the disappearance of the membrane.

In view, therefore, of the possible very close resemblance of these two diseases, it will be extremely dangerous to be content with a merely clinical diagnosis. However positive one may

be of the correctness of his judgment, the risk that attends a possible blunder is too great for us to be satisfied with anything less than the absolute knowledge afforded by the microscope and the serum tube. The same local treatment will answer equally well for both these varieties of inflammation, and involves the very gentle removal of the membrane and the spraying or syringing of the nose with some more actively antiseptic solution than the Dobell. A $\frac{1}{2}$ per cent. solution of formalin is an effective application, and after the fossæ have been medicated as thoroughly as possible with this, an antiseptic and astringent powder may be insufflated. Resorcin or aristol blended with stearate of zinc as a base answer very well and will retard and gradually check the reproduction of the membrane. I need not add that the general condition of the patient demands careful attention.

CHRONIC RHINITIS.

1. Simple chronic catarrhal rhinitis. 2. Hypertrophic rhinitis.
3. Atrophic rhinitis. 4. Specific rhinitis—syphilitic, tuberculous, lupoid, etc.

1. Simple Chronic Catarrhal Rhinitis.

This is an extremely common form of chronic nasal catarrh. Probably the majority of cases of chronic rhinitis that come to us are afflicted with the obstructive or hypertrophic form of the disease; but there is another, and not a small proportion, who present merely a chronic catarrhal inflammation of the nasal tissues unassociated with any hyperplasia or other structural alteration worth mentioning. Comparatively very few of those who suffer from this latter condition seek relief. By far the larger number put up with the annoyance that it occasions, become more or less used to it, and are never quoted in statistics.

Etiology. The disease usually originates in a series of coryzas from which, recovery being incomplete, a continuous instead of

an intermittent catarrhal process is finally established. The determining cause of this chronic condition is also quite often a severe attack of grippe or influenza, or one of the infectious fevers; and finally one's occupation or climatic environment may involve irritative influences that may also be active in its causation. Some underlying diathetic state often contributes to the establishment and maintenance of the process, and even more frequently than this, a chronic catarrh of the gastro-intestinal tract.

Symptomatology. The principal complaint from these patients concerns the ease and frequency with which they catch acute colds. They are scarcely ever entirely free from some of the lesser symptoms of coryza. There is always hypersecretion which varies in its consistence and quantity at different periods of the day. If the nose is not more or less "stuffy" all the time it becomes so on very slight provocation, the gentlest draught, a little dampening of the feet, or a cloud of dust being enough to occasion sneezing and excite increased secretion. In children particularly epithelial desquamation may be so rapid and continuous that the discharge acquires a purulent character and gives birth to the disease entitled purulent rhinitis. As a consequence of the relaxed and rather flabby condition of the turbinate tissues sudden engorgements are not uncommon, and one or the other side of the nose is usually somewhat obstructed.

Diagnosis. This should not be difficult as a rule, but we may at first be misled by the fact that these cases are apt to come to us shortly after an acute coryza, and, therefore, it is not uncommon for us to find at our first examination more or less engorgement and dull hyperæmia of the turbinates which might lead us to believe them hypertrophied. Questioning, however, will elicit one fact at least that will remove this suspicion. Although the patient is most of the time conscious of some obstruction within the nose, yet there will be occasional brief periods when under peculiarly favorable external and internal conditions both

nasal chambers will be perfectly free and open. Of course this could not happen if any amount of turbinate hypertrophy were present, because in that case we would have *continuous* obstruction proportionate in degree to that of the hypertrophy. Another method of demonstrating the absence of any hyperplasia of the mucous membrane is to spray or brush it over with a 2 or 4 per cent. solution of cocaine. A temporary turbinate tumefaction due to simple vascular distention will promptly subside under this and leave the fossa widely patent, whereas if we are dealing with a genuine hypertrophy even the powerful assistance of the suprarenal solution will fail to restore to the fossa its capacity. Although we may thus assure ourselves of the real nature of the disturbance, yet it is most important from the point of view of treatment that we thoroughly acquaint ourselves with every factor that may have contributed to its origin and progress; and this applies with particular force to any constitutional state or any functional disorder that would exert a disturbing influence upon the vascular supply of the nasal mucous membrane.

Prognosis. The ease and rapidity of cure will depend upon the duration of the disease previous to our undertaking its treatment, and upon the degree of success which attends our efforts to remove or control the causes that have led to it.

Treatment. **GENERAL.** This takes precedence of the local treatment, because it is much more important than the latter in the securing of completeness and permanence of cure. Local measures alone may be soothing and palliative, but cure can only follow the removal of the systemic factor or the hygienic fault that will always be found to have played a prominent part in the etiology of the disease. Almost the first step toward the accomplishment of this will lead us in the direction of the gastrointestinal tract. If the digestive and general nutritive processes are conducted aright, neurotic temperaments, uric-acid diatheses, and such things will soon cease to play any part in the encouragement of the catarrhal process. To secure this end both doctor

and patient should depend upon drugs as little as possible. Judicious regulation of diet and exercise, of the tobacco, alcohol, coffee, tea, and confectionery habits, and insistence upon proper clothing, will have much greater remedial value than the cleverest combinations of drugs. Normal activity of all the excretory organs must be carefully and constantly maintained. Constipation must be relieved as quickly as possible, but its cure will be better gained by appropriate food and exercise than by laxative pills and waters. An abundant consumption of pure water will assist the kidneys in disposing of the more soluble impurities, and active exercise will not only do much to equalize the distribution of blood throughout the body and so dissipate local congestions, but it will also stimulate the very valuable eliminative power of the skin. In this latter connection a word about bathing. The cold bath, whether it be in the form of plunge, shower, or sponge, has been greatly abused in this country. Judiciously used cold water is of immense value as a neurovascular tonic and stimulant, but used indiscriminately and without any reference to the condition of the person for whom it is prescribed it is capable of inflicting serious if not fatal injury. Under the impression that it will harden them and render them less susceptible to colds, large numbers of men and women, entirely unfit physically for any such shock, are in the habit of jumping from their warm beds into intensely cold baths. In spite of their screams many children are subjected to the same Spartan treatment, in entire disregard of the fact that our domestic conditions and habits of life are widely different from those of Leonidas and his countrymen. Cold bathing is not adapted to those who are physically below par, who are rheumatic, or who have any inherited or acquired constitutional fault that renders them incapable of easily and promptly overcoming the primary depressing effect of the sudden change of temperature. Even for those who have none of these disabilities it is better that the cold bath should always be preceded by several minutes of vigorous exercise ; and

if it be followed by smart friction with coarse towels or flesh-brushes, and then perhaps by an alcohol rub, the prophylactic power of this remedy against colds will be wonderfully increased.

In those people who cannot or will not take a proper amount of exercise we must resort to the Turkish bath as a means of keeping surface elimination somewhere near the normal. But it is a very poor substitute for exercise, there is nothing invigorating about it, and it is no more than a lazy man's method of promoting skin-breathing. All the contrivances for introducing the hot-air bath into the home that have appeared within the last few years, while being of value to a limited number who cannot indulge in any vigorous muscle work, are objectionable, because they tempt a far larger number of indolent patients to shirk their exercise and content themselves with the temporary and deceptive benefits of this therapeutic measure.

The Turkish bath proper has often seemed to be harmful because it has been taken too frequently or because certain precautions that should always be observed have been neglected. Those for whom we advise this form of bath should be told never to take one within less than two hours after a meal, to always moisten the head before entering the hot-air chamber, and not to take a cold plunge afterward. Unless one is exceptionally vigorous it is safer to cool off gradually under a shower, the temperature of which is slowly reduced, than to subject one's self to the violent shock of the plunge.

In order to make these brief remarks upon personal hygiene complete we must consider for a moment the subject of clothing. The not infrequent periods of intense heat during our summers justify the lightest possible clothing while they last, and similar extremes of cold during the winter will require an unusual amount of protection; but these extremes are only occasional, and probably a medium weight of woollen underwear is theoretically to be preferred the year round. Almost from October to May it is the rule that our dwellings are overheated. No system

of warming our houses has yet been devised that will keep them automatically at an even temperature, and consequently we are constantly exposed to the discomforts and dangers that attend the carelessness or ignorance of our domestic stokers. It will be readily apparent then that if we are enveloped in a medium-weight underwear we will be enabled to save much time and trouble in accommodating ourselves to changes of temperature by simply altering the number or weight of our outer garments. The very heavy woollens that many people wear during the winter are more of a menace than a protection to health. When thus clothed the skin becomes moist and relaxed within doors, and upon going out chilling is apt to occur, even in spite of a very warm outer coat or wrap. There is another class of people who seem to regulate their clothing by the calendar rather than by the thermometer. It is foolish enough to commence the wearing of winter underclothing with the beginning of November, but it is a much more dangerous folly to abandon it for a thinner texture just because there happens to occur a mild day or two in late March or early April. Our climate is much too treacherous to permit any such trifling with it as this.

I cannot conclude this sketch of the general treatment of these cases without advising my younger readers, those who may not fully appreciate its necessity, to pay particular attention to their patient's vices. In men we have to contend most commonly with tobacco, alcohol, and sexual excesses; while in women we must take account of bon-bons and sweets of all kinds, and not infrequently of the immoderate use of coffee and tea, particularly the latter.

For the man with nasal or throat trouble tobacco is a decidedly noxious weed. It is not only an active local irritant when either smoked or chewed, but if used at all freely it is almost certain to provoke more or less gastric catarrh, which will impair digestion and nutrition and favor the continuance of any catarrhal process situated in the upper portions of the digestive or air tracts.

Alcohol will have precisely the same effect and an even more marked action in producing vascular dilatation and general congestion of the pharyngeal and respiratory mucous membranes.

As to sexual excesses, they are of such frequent occurrence and are so potent in the production of functional disturbances that I offer no apology for introducing here an abstract of some notes on the subject that I published a few years ago. I regard it as too important a one to be lightly dismissed.

“It is a matter of common knowledge that sexual excitement, frequently repeated and prolonged, can occasion a great deal of vascular disturbance within the nose. A fugitive coryza quickly following upon the heels of a venereal debauch is an instance of this, though it is a more than usually pronounced illustration of the effect of erotic excitement upon the nasal vasomotor mechanism. Lesser degrees of the same effect, however, are of much more frequent occurrence I suspect than many of us believe; and it is because of their frequency and the influence they exert in aggravating existing nasal disease and in hampering the action of local or general treatment directed to its cure that they become worthy of some special study.

“Among the mass of our patients it is in but a comparatively small number that we find sexual excitement an active cause of trouble. For the sake of convenience they may be grouped within two fairly well-defined classes. First we have a number of young people whose exposure to it is largely innocent, one might almost say legitimate—I mean those who are on the brink of wedlock, those who are availing themselves of the privileges which custom accords to the preliminary betrothal. Thackeray, in his ‘Shabby Genteel’ story, refers to them as ‘those who are legally engaged in sighing, gazing into one another’s eyes, hand-squeezing, kissing, and so forth (for with such outward signs I believe the passion of love is expressed).’ This transition stage between celibacy and marriage is one of acknowledged risk. Long engagements have, for many excellent reasons, been

denounced time and again ; and the intimacy and the excess of tenderness which too commonly accompany them are accountable for much suffering, both immediate and remote. As long as 'the flesh and the devil' are mixed up with human love affairs, so long as the average man's love is so strongly sensual and so feebly spiritual, so long will protracted engagements be baneful.

"It will be my endeavor to show by a single example how the nose and its diseases may be affected by the emotional turbulence of this prenuptial period. It is that of a young woman whom I first saw in October, 1893. She had had attacks of hay fever in each of the three preceding years, and following the one of 1893 she had developed symptoms of asthma. The nasal examination disclosed a pair of turgescient inferior turbinates, while those immediately above them were found greatly hypertrophied, and along the lower margin of the left a fringe of budding polyps. These latter were thoroughly eradicated with the curette and the bodies themselves reduced by a few repetitions of chromic acid cauterization. The erectile tissue of the lower turbinates regained its full contractile power under simple astringent medication, the asthmatic paroxysms ceased, and the next two years passed with no recurrence of the hay fever. The early months of 1896 were spent in Florida, and when my patient returned to Philadelphia she was wearing an engagement ring. The man in the case was barely twenty-five—a veritable Romeo in the ardor of his passion, and blessed with enough health and virility for two ordinary men. The engagement had been of but slightly more than two months' duration when the young woman reappeared in my office with a complaint of renewed nasal discomfort. The middle turbinates were again markedly hyperæmic and the lower greatly engorged and prominent. Two or three weeks of the local treatment that had previously been successful in reducing these latter made very little impression upon them now, and a threatened return in the early summer of the hay fever symptoms induced me to send for the young man and persuade him to assist me in

my effort to relieve the sufferer by becoming considerably less demonstrative of his affection for her. Parenthetically it may be hinted that sexual intercourse, even though carried to considerable excess, is less provocative of damage to the nasal erectile structures than frequent and prolonged sexual excitement which remains ungratified. For so young a man this one received my remonstrance very sensibly, exercised more self-restraint than I had expected, and with the result that within a couple of weeks the engorged turbinates had shrunk almost to normal, the hyperæmia of the middle ones was scarcely noticeable, and there was an entire subsidence of nasal symptoms. The inference is unmistakable. Nothing would be gained by the addition of other examples more or less reiterative of this one, but I may be pardoned for alluding to the tact that is essential in securing the co-operation of one or both of the young people without hurting their feelings or giving any offence. I would not be suspected of wishing to dim the brightness of 'love's young dream,' but if one of the dreamers chances to have any catarrhal condition of the upper air tract, a few judicious words counselling patience before and moderation after marriage may if heeded be preventive of a decided aggravation of such condition.

"I pass to the consideration of a second class, the members of which, however, are far from being as innocent as those of whom I have just spoken. It is composed of the man-about-town, single or married, youthful or mature, the sybarite, the voluptuary, the libertine. Whatever we may choose to call him, he is a very numerous personage; and though he may escape those specific diseases which so frequently roughen the way of this variety of transgressor, yet sooner or later his nose may become the humble agent of retributive justice. The man who enters a physician's office with a venereal disease anticipates the kind of questions he will be asked, and is generally willing to answer them unreservedly; but he who comes to the rhinologist with merely a complaint of nasal obstruction, of more or less rhinor-

rhœa, and perhaps of some dull, frontal headache is apt to be astonished, and not unlikely resentful, if he be closely questioned concerning his sexual morals. I do not know whether it is dread of the patient's displeasure or simply a want of appreciation of the frequency and potency of this genetic factor in the history of functional nasal disturbance that leads to the omission of such inquiries, but they are the exception rather than the rule. The exercise of a little discrimination, of perhaps a little common-sense, will protect a large proportion of our male patients from being subjected to an investigation of this nature; but in many others there will be fair reason to suspect moral laxity, and in these there should be no hesitation in either confirming the suspicion or in taking the fault for granted and dealing with it frankly and vigorously.

"I have met with sufficient of such cases during the past few years to open my eyes to the fact that some early failures to effect in them decided and permanent improvement were due to my failure to recognize and remove the principal cause of their annoying symptoms. A brief reference to the patient who first enlightened me on this point may be of interest.

"He was a widower, just turned forty, handsome, well-read, widely travelled; a man of most versatile cleverness—an excellent musician, something of an artist, and an occasional writer of very fair verse. All these merely personal details are distinctly relevant, because they are the very things which make a man *persona grata* to the other sex, and which consequently expose him to greater temptations than his less attractive fellow. In such men, therefore, we may look much more confidently for easy virtue as an exciting cause of nasal trouble than in those to whom nature has been less kind. This man recited a list of symptoms that was suggestive of enfeebled vasomotor control over the circulation of the pituitary membrane. There were brief intervals during which he was comparatively comfortable; but the greater part of the time he was seriously annoyed by nasal obstruction,

by marked hypersecretion, by occasional paroxysms of sneezing, and by some dull, frontal headache. An accompanying marginal blepharitis also testified to the intranasal irritation. His statement that he had already endured considerable treatment was amply confirmed by my rhinoscopical examination. His turbinates, both inferior and middle, presented an array of galvano-cautery cicatrices that reminded one of the scarred faces of the German duelists. This seemed to have been the favorite local treatment; but in addition a fancied neurotic temperament had been assailed with many pills, a suspicion of gout had been threatened with drowning by gallons of lithia water, and finally someone had tapped both his antra through the inferior meatus as a sort of forlorn hope. It was only a happy accident that saved me from the fate of my predecessors. A review of the treatment he had received yielded me little hope of finding anything of promise that had not already been tried. The end of a month of tentative local treatment, of regulation of diet, exercise, and some other matters of personal hygiene found us but little beyond the point from which we had started. But just at this critical juncture, when I could detect some slight signs of disappointment and failing confidence on the part of my patient, a bit of scandal came to my aid. It was the whisper of an intrigue in which my patient was playing the rôle of Juan. At our next interview he admitted without any reluctance the habitual looseness of his conduct with women. He made no attempt to conceal his amused incredulity when I charged this vice with being largely responsible for his nasal discomfort, but he agreed nevertheless to give virtue a month's trial. Not to rob this remedy of any possible credit, all other treatment was for the time suspended. Brief as it was, the period of probation proved more than sufficient to vindicate my faith in the prescription, and I was able to dismiss my patient with the assurance that his best safeguard against future return of this trouble would be a rigid observance of the spirit as well as the letter of the seventh com-

mandment. It is always my endeavor to be as sparing as possible in the use of drugs; but in cases such as this, where from long disuse self-control has undergone a shameful enfeeblement, the bromides or any of the other anaphrodisiacs may be utilized to dull the vicious appetite until sufficient will-power is regained to completely conquer it."

Finally, the intemperate use by women of all kinds of sweets, of coffee and tea, and, in these degenerate days, of even alcoholic stimulants, may seem too insignificant or of too infrequent occurrence to deserve notice; but it is to be remembered that anything which tends to disturb the stomach, to excite fermentative dyspepsia or other digestive fault, is not to be sneered at as being unworthy of investigation and correction.

LOCAL. If the foregoing general measures are as strongly insisted upon by the doctor and carefully observed by the patient as I have urged should be done, the simple catarrhal process affecting the nose, and probably to some extent the nasopharynx, will almost subside of itself. Its disappearance can be considerably hastened, however, by appropriate local management. Remembering that the nasal mucous membrane is always hypersensitive at the commencement of treatment, the preliminary whiff or two of the 1 per cent. cocaine spray is to be recommended. During the few moments that are required for this to exert its effect the patient's mouth may be opened and his fauces and throat sprayed with the cleansing alkaline solution. The nasal speculum is then introduced and the fossæ thoroughly washed out. No meatus should escape, and if any of them should be shut off by swelling of the lower or middle turbinates, these should be reduced by lightly brushing them with the cotton carrier dipped in a 2 per cent. solution of cocaine. The chambers are then resprayed with the wash, and this may be followed for the first treatment or two by the 1 to 3 witch-hazel solution. In the wake of this we may moisten the cotton tip of our applicator with the benzoïnol solution of camphor and menthol

(āā gr. xv-fʒj) and carry it through the lower meatus back to the pharyngeal wall. On withdrawing it it should be swept outward beneath the lower border of the inferior turbinate and the space between this body and the outer wall thoroughly mopped and medicated. Surprising quantities of mucus are apt to collect in this space and remain there in spite of the spray and vigorous blowing of the nose. The upper portion of the fossa is usually too sensitive to permit of its treatment by the applicator, and so we may resort to a benzoinol or albolene spray for the purpose of reaching its recesses. One or the other of these used as a base may contain other more active agents in solution, and an excellent formula is this of Douglass :

R.	Thymol	.	.	.	.	.	.	.	gr. x.
	Menthol	.	.	.	.	.	.	.	gr. xx.
	Eucalyptol	.	.	.	.	.	.	.	gtt. xx.
	Ol. cubebæ	.	.	.	.	.	.	.	gtt. xl.
	Benzoinol	.	.	.	.	.	.	.	fʒvj.
	Ol. rosæ	.	.	.	.	.	.	.	gtt. x.—M.

A little sneezing may follow this treatment, but in a few moments the nasal chambers will feel delightfully clean, clear, and comfortable. A few repetitions of such treatment at intervals of two or three days will materially lessen the hyperæsthesia of the tissues and prepare them for something more energetic. This may be Boulton's solution, which will displace the witch-hazel. Though a little pungent at first, this is not unpleasant, and after a brief course of it the mucous membrane gradually loses its sluggish hyperæmia, the relaxed erectile tissue contracts somewhat, and the oversensibility of the nose to draughts, dust, etc., will be found to have diminished. Should some of this still remain, however, and the turbinates continue to become over-distended with annoying frequency, a light touching of them with fused chromic acid crystal will almost invariably restore their normal contractility. No broad band or even thin line of this is to be drawn upon their surface, but they are merely to be touched at a few of their more prominent points.

It is superfluous to add that the patient's share in the local treatment will be the daily use of the Dobell or other alkaline wash. He is to be shown how to use this properly, and the nasal chambers should be well cleansed with it morning and evening.

Purulent Rhinitis. The purulent rhinitis of children, leading as it often does to the atrophic form of catarrh, deserves some special attention. In this disease there is not only more or less inspissation of the muco-pus and consequent crust-formation within the nose, but in the vestibule and along the borders of the alæ, as a result of the irritating quality of the secretion, there is apt to be considerable eczema.

It is highly important that this affection, perfectly innocent and simple in its nature, should not be confused with congenital nasal syphilis, which is so notoriously destructive in its effects. In the one disease we find upon cleansing the fossæ a perfectly intact though highly catarrhal mucous membrane; whereas in the other we will find erosions, probably ulceration, and possibly denuded and necrosed bone. With such conditions we will have some blood mingled with the discharge, which will also be distinctly fetid. There can scarcely be any diagnostic doubt in the presence of such lesions, but nevertheless a careful examination of the parents should be made, in order that the diagnosis may be positive.

The treatment of purulent rhinitis will demand more frequent cleansing than the ordinary morning and evening use of the spray, and if the child will not submit to the employment of the atomizer the mother or nurse should use the rubber-ball syringe, the soft, flexible tip of which will cleanse without injuring the intranasal structures. After thorough cleanliness has been secured a mildly astringent solution should be used in the same manner as the wash. The object of this will be not only to reduce the hyperæmia present, but to restrain the rapid cell desquamation which is the chief characteristic of this disease. Sulphocarbolate of zinc, five grains to the ounce, is a very satis-

factory astringent, or in place of this we may use the glycerole of tannin. This may be given to the attendant, and every evening at bedtime, after the use of the wash, a little of it may be introduced upon a camel's-hair brush within each nostril. In obstinate cases nitrate of silver, three to five grains to the ounce, may be employed in the same way. The general condition of these children should be brought to the highest point possible. They should spend the greater part of the day out-of-doors in the sunshine and fresh air, and their food, clothing, and bathing should be closely supervised. Tonics may be given if necessary, but exercise and the oxygen of a pure atmosphere are vastly better than those of the pharmacopœia.

2. Hypertrophic Rhinitis.

The term hypertrophic as here used should be taken in a limited sense as indicating merely the enlargement of the turbinated bodies, and not as descriptive of the actual pathological change that has occurred in their component tissue elements.

Etiology. Whatever may originate and maintain a catarrhal hyperæmia of the nasal mucous membrane may contribute to the birth and growth of the disease. What has been said, therefore, of the causation of simple chronic rhinitis is equally applicable to this affection. The simple chronic catarrh is itself always preliminary to the hypertrophic form, but the progressive connective tissue hyperplasia which distinguishes this latter disease is not the invariable outcome of the simple catarrh. On the contrary, a purulent rhinitis of chronic type may gradually supplant the simple process, and this be but the stepping-stone to the atrophic form of rhinitis; or, on the other hand, the catarrh may remain persistently simple for long periods, without any tissue increase or degeneration worth mentioning.

Headed by Bosworth, a number of rhinologists contend that the invariable precedent of turbinal hypertrophy is some form

of anterior nasal obstruction. This may be a septal deformity, collapse of the alæ, or perhaps the presence of a neoplasm.

The theory of their action is eminently simple. As a consequence of the opposition which they offer to the entrance of air during inspiration, a partial vacuum is created within that portion of the nasal chamber behind them. This being lined by a soft and yielding tissue the vessels of which dilate in the effort to fill this vacuum, an increased supply of blood is occasioned which exaggerates normal nutritive processes and gives rise to abnormal tissue growth. No exception can be taken to this theory as accounting for a large proportion of the cases of hypertrophic rhinitis, but a large number still is left which cannot be so explained. These latter we must be content to regard as the outcome of a long-standing, simple catarrh the determining and predisposing causes of which have already been mentioned.

Pathology. Increased blood supply being within certain limits synonymous with increased nutrition, it is obvious that with favoring local and general conditions overgrowth of the constituent tissues of the turbinated bodies can be only a question of time. This hyperplasia does not always involve the different tissues equally. At times the turbinate enlargement is chiefly of a vascular nature, it being due to dilatation of the large venous sinuses and to numerical increase of the arterioles and capillaries. Again, it may be principally dependent upon hyperplasia of the connective tissue and glandular elements of the submucous layer. Whatever the differences of detail that the microscope may disclose, however, the gross result is always the same—such an increase in the size of the turbinate that the normal capacity of the nasal fossæ is seriously diminished, and as a consequence of this a proportionate diminution in the functional activity of the nose.

Symptomatology. The symptoms that accompany and testify to the pathological alterations within the nose proceed from disturbance of nasal respiration and secretion, and in a

degree of the sense of smell. There are in addition associated symptoms involving the eyes and ears, and in patients of a neurotic turn there are apt to be headaches and other nerve symptoms of a reflex nature. These are particularly apt to occur in those cases which present a marked degree of enlargement of the middle turbinates. Such a hypertrophy of these as will bring them in contact with the septum may occasion not only neuralgias and other symptoms of nerve pressure, but drainage from the upper meatus will be more or less obstructed, leading to retention of secretion and the irritation which will accompany its decomposition. Again, overgrowth and impaction of these bodies will be attended by disturbance of circulation in the lymphatic and venous channels which connect them with the base of the brain. It is in this close anatomical connection that we will find the explanation of many cases of obstinate frontal headache and persistent mental hebetude in middle turbinate hypertrophy. These bodies, therefore, should always be examined most carefully, and we will be well repaid for the study that we devote to them by often discovering in their diseased conditions the cause of many obscure symptoms that may have quite defied diagnosis by others. One of if not indeed itself the most noticeable of the symptoms of hypertrophy of the lower turbinates is the mouth-breathing that is always present, if not throughout the whole twenty-four hours at least during that portion of it given to sleep. As a consequence of it, and in direct proportion to its constancy, there is dryness of the pharynx and larynx, some huskiness and alteration in the quality of the voice, and perhaps a tendency to clear the throat rather frequently. The sense of fulness or pressure within the nose is quite frequent, and with this some dull frontal headache is commonly associated. The secretory disturbance varies. Although it is as a rule diminished in amount, there may be a seeming increase owing to the fact that it is of thicker consistence than normal and its accumulation necessitates a more frequent use of the handkerchief. As would naturally be supposed,

it is most noticeable in the morning on rising; and it is also at this hour that the dryness of the mouth and throat is most pronounced as a result of the night of mouth-breathing. The eyes are quite often the seat of a marginal blepharitis, and the lumen of the nasolacrymal canal may be seriously narrowed by obstructive enlargement of the lower turbinated body. Impaired audition and tinnitus may follow an extension of the catarrhal process to the Eustachian tube and middle ear.

Inspection of the fossæ discovers a group of turbinates of a much deeper color than that of health, and perhaps this may be somewhat obscured by the presence of more or less secretion. Portions of this will probably have undergone inspissation, and small flakes or thin crusts may be found on the septum or upon the sloping surfaces of the turbinates. These are quickly expelled, however, and never remain long enough to acquire any size or to occasion any odor. The amount of hypertrophy present cannot be accurately estimated by mere inspection, and so with the cotton carrier we brush a little of a 4 per cent. solution of cocaine over the surface of the enlarged turbinates, and at the end of four or five minutes note the shrinkage that it has effected. In genuine hypertrophy this will be very slight, whereas in mere temporary engorgement of the erectile tissue complete collapse will have occurred. Without the assistance of cocaine we may distinguish with a fair degree of certainty between these two conditions, by pressing upon the swollen body with the naked probe. In hypertrophy, though the pitting will be slight it will be but slowly effaced upon removal of the pressure, while in simple vascular dilatation the pitting though deep will remain but a moment.

The hyperplastic process is seldom evenly distributed throughout the whole extent of the middle and lower turbinates, but is apt to be more pronounced at some points than at others, and this gives rise at times to considerable irregularities of these bodies. One of the most common of these is the very great hypertrophy

of the posterior extremity of the inferior turbinate. In the rhinoscopic mirror this is seen as a large and rather pale mass, with rough, mulberry-like surface, which may almost completely occlude the lower and middle meatuses.

In the diagnosis of this disease the lower turbinates are much less apt to puzzle the beginner than the middle ones. These latter are but rarely as easily and completely examined as are the inferior bodies. There are several conditions which may make their satisfactory inspection a matter of considerable difficulty. A deflection of the septum or a ridge of any prominence upon it will partially conceal them; a more than usually prominent bulla ethmoidalis may project itself inward beneath their anterior extremities, and so obstruct our view of them; or finally a congenital narrowness of the nasal fossæ will limit our view to merely their lower borders and leave us quite in the dark as to their real bulk. Experience and habitual care in the examination of these bodies, however, will do much to enable us to judge from the appearance of a comparatively small portion of them as to the condition and size of the remainder. Cocaine and the suprarenal solution applied to the enlarged lower turbinate and to the usually thickened septal mucous membrane will frequently lead to the exposure of much more of the middle turbinates than we could otherwise see. When they share in the hyperplastic process it is as a rule their anterior extremities and the anterior half of their lower borders that show the greatest enlargement. In gouty or neurotic patients who are subject to neurovascular disturbance within the nose, or in those who have a purulent inflammation of the frontal or maxillary sinuses or of the ethmoidal cells, it frequently happens that the middle turbinates are swollen, boggy, and œdematous. It is highly important that such a condition and its cause be clearly recognized, and that it be not regarded and treated as a phase of hypertrophic change.

Diagnosis. In the absence of neoplasms or septal deformities the complaint from the patient that there is *always* more or less

obstruction to nasal breathing, or that there is *never* perfect freedom of respiration through this cavity, are almost enough of themselves upon which to found a diagnosis. The turbinal swellings that result from suspension of vasomotor control over the capillaries and venous sinuses are usually of brief duration, and though they may occur quite frequently in those of gouty or neurotic tendencies, yet there are periods of complete remission during which nasal breathing is carried on uninterruptedly and without the slightest effort. This cannot be said of hypertrophic rhinitis, in which disease there is a certain amount of obstruction that is constant. While examination, therefore, will confirm our suspicions and enable us to ascertain just the amount of hypertrophy with which we have to deal, we may yet be pretty well assured of the nature of the disease before the examination is made.

Attention may here be called to a rather singular fact in connection with nasal obstruction in general, and that is that it is exceptional for patients to be able to say with any positiveness which nasal fossa is the more obstructed. Even when one side is quite clear and the other markedly stenosed it is not infrequent for patients to indicate the open side as being the one through which they breathe with the less freedom. Such uncertainty and actual blunders indicate nothing more probably than a great lack of observation on the part of the patient.

Prognosis. In uncomplicated cases we may safely promise to remove the obstruction and restore normal nasal respiration; yet this may require some time for its accomplishment and we should be cautious about naming a definite period. If the hypertrophy has been of long standing also and of marked degree we should not be rash in promising complete relief to the secretory disturbances. The normal functional activity of the mucous membrane will have been somewhat crippled by the prolonged catarrh and hyperplasia, and a certain amount of this may be permanent in spite of the most judicious treatment.

Even with the most energetic care on the part of the physician so much of the certainty and rapidity of cure depend upon the complete and unremitting co-operation of the patient that our prediction regarding the result must always be conditional.

Treatment. In commencing the treatment of these cases it is desirable that we have a well-defined idea of what we wish to accomplish. Our ultimate object, of course, is to reduce the hypertrophied bodies to such an extent that nasal respiration will be re-established and again become the method observed at night as well as during the day; but in the accomplishment of this we should never employ, if it shall be possible to avoid them, such measures as will impair to any appreciable extent the future functional value of the nose. This is a feature of the treatment that should never be lost sight of, and if it be accorded the respect that it deserves radical surgical procedures will be held in reserve as last resorts, and if finally adopted will be strictly limited to the necessities of the case. A very large proportion of hypertrophic catarrhs will yield to conservative measures, and I know of nothing that has subjected rhinology to so much severe and deserved censure as the recent and happily fast waning vogue of the galvanocautery. Unquestionably valuable as this aid is when judiciously employed, it is humiliating to reflect upon the shameful manner in which it has been abused. Instead of being a last it has too often been a first resort of the ignorant and thoughtless, and the amount of injury that has been inflicted by it is incalculable. It is important then that the patient shall be made to understand that an established pathological process which is the outcome of months or years of a chronic inflammation is not to be overcome in a few days or weeks. It is quite true that the mere mechanical effect of this inflammation—the obstructive hyperplasia—can quickly be gotten rid of by means of the cautery, snare, or other instrument; but the process itself requires much more time for its arrest, and if we are not permitted to secure this by having a sufficient period allowed us for

its treatment a recurrence of the obstruction will be but a question of time. It will be readily perceived then that the restoration of the normal patency of the nasal chambers is but a portion of our work. The measure of our success in treatment will be found in the permanency of the relief that we afford.

Upon the completion of the examination of the nose and throat and the establishment of the diagnosis we are not prepared to commence the local treatment until we have subjected the patient to a thorough questioning concerning his general health, his occupation, and his habits of diet, exercise, dress, and bathing. As to his general health, we should make ourselves familiar with everything of a systemic nature that can exert any favoring influence upon the local disease. Diathetic disorders should be carefully searched for, and every organ should be examined that we may know whether it is guilty or innocent of being a contributing factor. There is no mystery about the success that comes of being thorough, nor is there anything surprising in the inevitable failure that attends carelessness. A great deal of tact must usually be employed in persuading men to reduce their allowance of tobacco and alcohol, and women their sweets and coffee and tea. The excessive use of the latter two articles is much more common than may be usually supposed, and should always be inquired about. Our greatest difficulty in the general management of the patient, however, will be encountered in the effort to overcome the habit of overeating and the indisposition to take a proper amount of exercise. It will not be one or a dozen warnings that will correct these matters, but our inquiries and protests must be repeated again and again until the patient is weary of his own weakness and cannot excuse his indiscretions by any indifference to them on our part.

Having, so far as possible, cleared from our path all these obstructions to a successful issue, we are ready to attack the disease locally. Here our energies will be wholly directed to arresting the catarrhal process and effecting retrograde changes

in and absorption of the tissue hyperplasia that it has occasioned. I think it may be of greater practical assistance to the beginner to give him an outline, subject of course to modifications, of the routine office treatment of a case of this kind, as nearly as possible as he would conduct it himself. In chronic as in acute rhinitis the mucous membrane is at first highly sensitive, and the preliminary momentary spray of the 1 per cent. cocaine solution will be desirable. While this is taking effect two or three applicators may be tipped with cotton and laid upon the table, and then the alkaline wash should be sprayed gently, but pretty generously, into the nasal chambers. If any quantity of secretion be present it should now be blown from the nose and the spraying repeated. This second supply of the solution is to be drawn back and down into the throat by the patient and then expectorated. If the anterior hypertrophy or engorgement of the lower turbinals be so great that the upper portions of the fossæ are not reached by the spray, one of the cotton carriers may be moistened with a 2 per cent. solution of cocaine and applied to the most prominent portions of the bodies. The middle as well as the inferior should be reduced in this way if necessary, and the spray then used as often as may be required to obtain proper cleanliness. At the first visit of the patient it will not be wise to introduce so vigorous a remedy as iodine in any of its solutions into the nose. It will be better to prepare the tissues somewhat by using at this time a mild astringent spray like the witch-hazel solution, and follow this with some of the camphor-menthol mixture on the applicator. This latter may be gently brushed over the surface of both the middle and lower turbinals and carried back to the pharyngeal wall. It leaves a pleasant odor and sensation behind it, and the patient departs feeling much the more comfortable for his first treatment. During the ensuing day or two he will use an alkaline spray morning and evening at his own home, and when he returns for the second treatment the nose will be found decidedly less sensitive than at the first. At this visit, therefore, after the

essential cleansing and a slight 2 per cent. cocainization of the more sensitive middle turbinates, iodine as combined in the Boulton solution (page 88) may be sprayed into the nose. This like the wash is to be drawn back by the patient so that the catarrhal nasopharynx may share the good effects of the medicament. More or less sneezing and increased flow of serum will be caused by this solution, and for the next ten or fifteen minutes the patient will feel as though he had caught a fresh cold. When he returns once more to your office, examination of the nose will discover that the more superficial evidences of catarrh are disappearing. The hyperæmia will be less distinct, the submucous infiltration will have receded to some extent, there will probably already be perceptible some little shrinkage of the turbinates, and the sensibility of the mucous membrane will have markedly lessened. Having reached this point, therefore, we may advance another step in the energy of our treatment by using iodine in stronger solution. There are three commonly used formulæ in which glycerin is employed as the vehicle, and I give them here side by side :

	I.	II.	III.
R. Iodin. . . .	gr. viij.	gr. xij.	gr. xvj.
Potass. iodid. . .	gr. xxiv.	gr. xxxvj.	gr. xlviij.
Glycerini . . .	f 3 ss.	f 3 ss.	f 3 ss.—M.

The third of these is almost never used unless, perhaps, in some very obdurate case of atrophic rhinitis. The first two are quite sufficient to secure all the effect that iodine is capable of exerting in hypertrophic rhinitis. We begin, of course, with the weaker of the two, and before we introduce it within the nose it is no more than humane to lightly brush the lower border of the inferior turbinates with a 2 per cent. solution of cocaine. This may be immediately followed by the iodine preparation, which will be restricted entirely to the lower meatus. Indeed, the cotton wet with it is kept almost upon the floor of the nose, and merely swept outward beneath the border of the turbinate instead of being carried upward over its surface. This is a very pungent

application, and in the hyperæsthetic nose a little of it goes a great way. The first few times that it is used it is apt to occasion profuse lacrymation, sneezing, and serous rhinorrhœa. Its application should be quickly followed by one of the soothing, oily sprays, a very excellent one being the formula of Douglass (page 104). The effect of this iodine solution is to stimulate the somewhat sluggish capillary circulation and to provoke some contraction of the dilated venous sinuses. Glandular action also is aroused, and the secretion becoming more fluid is much more easily expelled. With improved vascular tension the natural absorptive processes are stimulated, and in the less mature hypertrophies, those in which organization of the newly-formed tissue is not so far advanced, a decided reduction may be effected in a few weeks by this method alone. After a few repetitions of the iodine it may be carried very gently up into the middle meatus, and the middle turbinate, if engorged or hyperplastic, lightly mopped with it. After some two or three weeks, when the nose has become somewhat tolerant of this No. 1 solution, and the amount of inflammatory reaction occasioned by it is too slight to be of value, we must substitute for it the solution of next greater strength. This will stimulate anew the activity of absorption, and further reduction of the hyperplasia may be looked for. If the patient shall be conscientious in his observance of our instructions concerning his personal hygiene, it is more than likely that at the end of six weeks or two months of treatment we will find the enlarged turbinates shrunken to such a degree that the patient is easily able to dispense with mouth-breathing for much the greater part of the twenty-four hours. It is probably only during profound sleep that the venous sinuses in the lower turbinates will relax, become overdistended, and compel the assistance of the mouth for breathing purposes. When iodine seems to have reached its limit of usefulness, and yet there is still an obstructive amount of hyperplasia present, we are confronted by the question of cauterization. Before resorting to this measure, how-

ever, it is quite worth while to try chromic acid as a stimulant rather than a cauterant. To get this effect from it we fuse a small crystal of it upon the end of a probe (Fig. 33), and instead of drawing a line or broad band of it along the cocainized surface of the hypertrophy we simply touch it lightly to some two or three points upon the more prominent portions of the body. This method of using chromic acid will take up the work where iodine has laid it down, and a few repetitions of it, at intervals of five days or a week, will effect a still further and perhaps a complete reduction of the remaining hyperplasia.

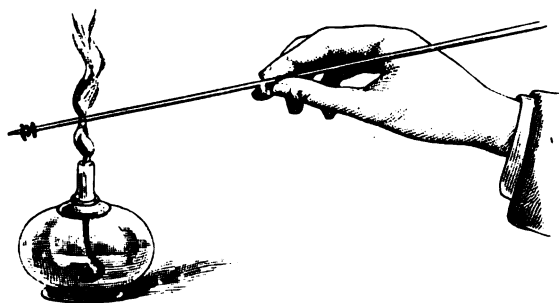
There is ample reason for believing that the treatment thus far outlined would, in conjunction with a rigid regulation of the patient's life, lead in much the larger number of cases to a practically complete cure of the chronic rhinitis and the resorption of the hyperplasia that has attended it. Unfortunately, however, it is rather a small minority of these patients who will be found willing to walk a hygienic chalk-line for a sufficiently long time to permit of their disease being cured. They may stick to it pretty bravely for the first two or three weeks, but as their nasal discomfort lessens their steps too often become uncertain and less firm, and then an opportune temptation only is needed to beguile them into some dietetic, alcoholic, or venereal excess that will be followed by others and do much to stay the progress of their recovery. In such cases as these, or in others where there are circumstances militating against cure, we may be compelled to forsake conservative and to adopt more radical measures. These latter include cauterization, the snare, and on rare occasions turbinotomy or turbinectomy.

Of the several cauterants my personal preference is for chromic acid. It seems to be the best of the chemical caustics, and over the galvanocautery it possesses several points of superiority. Its ease of application, the trifling amount of inflammatory reaction occasioned by it, its inoffensiveness to the patient—there being neither the startling hiss nor the odor of burning

flesh, and finally the fact that its employment requires no elaborate or expensive apparatus as does the galvanocautery— are all features that are greatly in its favor. The preparation of the nose and the mode of applying the acid are as follows: The nose is thoroughly sprayed with the alkaline wash and freed from all secretion. The turbinate to be attacked is anæsthetized with a 6 per cent. solution of cocaine. This strength is ample. It is not sprayed into the nasal fossa, nor are pledgets of cotton saturated with it introduced within the cavity and allowed to remain for some time. Both of these methods invite toxæmia, and should be discarded. The nasal applicator with its tuft of cotton affords us a perfectly efficient and as nearly as possible a perfectly safe means of anæsthetizing the mucous membrane. By this method we can easily measure the quantity of cocaine used and can limit it pretty closely to the points selected for cauterization. It is brushed over these points several times at short intervals, or it may be held steadily in contact with them for a minute or two. Four or five minutes are allowed to elapse that the drug may exert its full effect, and the surface of the mucous membrane is then well dried with absorbent cotton. This is for the purpose of preventing any solution and running of the acid, such as might happen were it applied to a wet surface. During the few minutes we allow for the cocaine to deaden sensibility we will slightly heat a probe, pick up two or three small crystals of chromic acid upon its tip, and then hold it in the flame of an alcohol lamp, as shown in the illustration (Fig. 33). As it becomes heated the crystals melt and upon cooling form a smooth, firmly adherent bead upon its tip. With the fossa well illuminated and the eye closely following its course this acid bead is now introduced into the nose and, without touching anything, is carried back about two-thirds of the length of the enlarged turbinate. Here it is placed in contact with the lower border of the body, and as it is drawn outward the acid leaves a white line in its wake. If the hypertrophy is a large one another line parallel to the first may

be drawn to the inner side of and above it or perhaps to its outer side. Care should be exercised in applying the acid that it be not allowed to touch the mucous membrane of the floor or that covering the septum. If this accident occurs the two cauterized surfaces may come subsequently in contact as a result of the inflammatory swelling, and we may have considerable difficulty in preventing their union. Within a half-minute the acid will have penetrated the tissue to a sufficient depth, and its further action is then to be checked by the neutralizing effect of the alkaline spray. Following this some of the powdered stearate of zinc with menthol may be insufflated, the turbinate well covered with it, and the little operation is at an end.

FIG. 33.



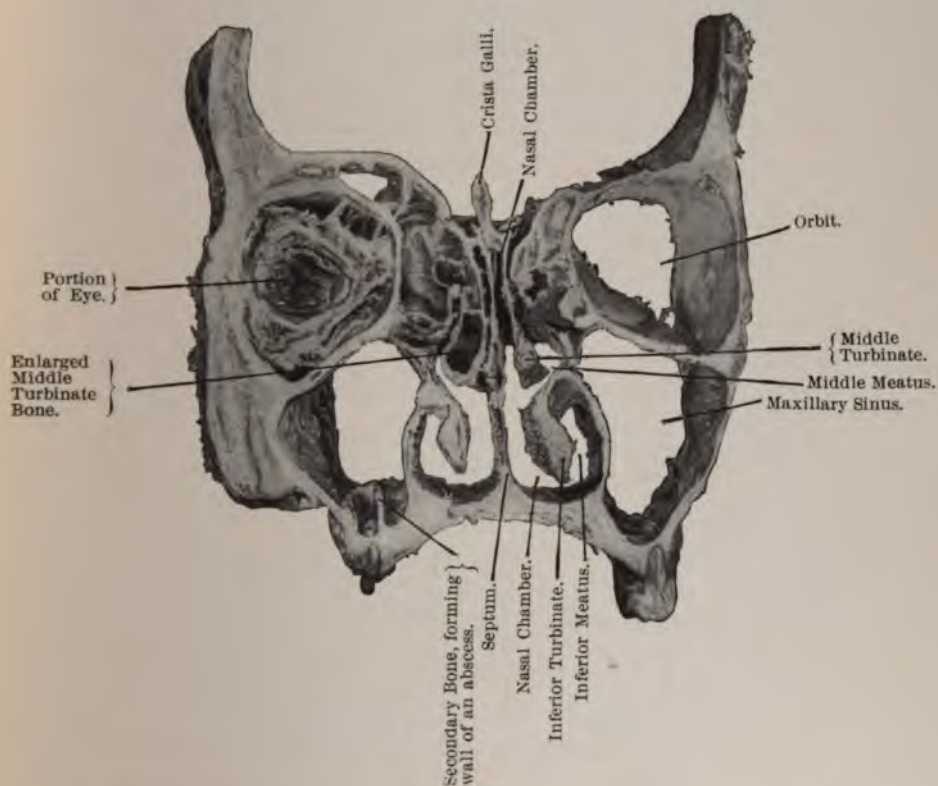
The nose should continue to be cleansed daily with the alkaline spray, but it should not be blown too vigorously, and the slough caused by the acid should be allowed to remain until it loosens and comes away spontaneously. This will usually occur in from five to eight days, but contraction of the cauterized tissue will continue for several days longer. If, therefore, it be proposed to repeat the application two weeks at least should be allowed to elapse from the date of its first use.

I have already intimated my dislike of the galvanocautery, but for those who may wish to use it I give here a method by which its objectionable features and possible ill-effects may be minimized. The preliminary preparation of the nose is precisely similar

to that for the chromic acid--the cleansing, cocainization, and drying of the mucous membrane. The removal of moisture in this case is for the purpose of preventing a sudden evolution of steam by the hot electrode that might scald the neighboring structures. During its introduction within the nose the electrode is kept cold until it reaches the furthest point that is to share in the burning. The blade is then placed in light contact with the mucous membrane, the circuit completed, and as the platinum tip reddens it is drawn forward toward the anterior extremity of the turbinate. No pressure is to be used, and the deep ditch that was once thought the proper mark for this instrument to leave should never be inflicted. The after-dressing is the same as for the chemical cauterant, and here also the ensuing slough should be allowed to remain until it loosens and is expelled in the natural course of events. A repetition or two of this superficial cauterization should effect a very considerable and possibly quite sufficient reduction in size of the enlarged turbinate. If, however, the hypertrophy is of extreme degree and involves the whole turbinated body rather evenly the better way to use the cautery is this: After cocainization and application of the suprarenal solution a slight incision is made in the anterior extremity of the turbinate. A blunt probe is inserted in this and pushed down to and for some distance along the bony framework. Upon the withdrawal of this an electrode with a long slender tip is pushed to the end of the ready-made path, and as it is heated and slowly withdrawn it is kept in close contact with the mucoperiosteum covering the bone. This method of cauterizing has the advantage of leaving no line or band of cicatricial tissue upon the surface of the mucous membrane, and that which is created lies so deep within the submucous layer that the glands are not implicated to any extent and the secretory function of the membrane is unimpaired.

Middle Turbinated Body. The anatomical relations of the middle turbinated body, its usually active participation in the

PLATE II.



Example of enlarged right middle turbinate, this being an instance of bony cyst formation.

diseases of the general nasal cavity, and the special and indeed characteristic symptoms that are apt to accompany its pathological conditions combine to give it a clinical importance that entitles it to some separate consideration. Disregarding for a time those diseases which involve its necrosis and more or less extensive destruction, reference will only be made here to its enlargement, the causes which lead to this and certain of its effects. The abnormally large size of the middle turbinate may in the first place be congenital, or it may be due to postnatal disease. An osteophytic periostitis, a rarefying osteitis, a cyst, or finally an abscess of the bone may severally be responsible for an increase in its bulk. Disease of the enveloping mucous membrane may consist of a simple hyperplasia—the degree of which may vary within wide limits—or the condition may be one of mucoid hypertrophy, so-called, or of polypoid degeneration. The diagnosis between disease of the bone and of the mucous membrane is not usually a matter of any difficulty. A little experience will enable us to decide almost by the use of the probe alone what it is that confronts us. Cocaine or the adrenalin solution may be of some little assistance, but they are not essential. When the bone is at fault the mucous membrane is usually stretched and thinned over the tumor, and the surface of this is apt to be rather smooth and not irregular. The probe will discover the unyielding character of the enlargement. In affections of the mucous membrane, on the other hand, the whole appearance of the growth is different. It is of much deeper color in hyperplasia, there is a suggestion of œdema or translucency in mucoid hypertrophy, and in polypoid degeneration a roughened, papillomatous surface. In each of these alterations the probe will easily indent the mass and show also that it has considerable mobility. The features which emphasize the importance and at times the gravity of middle turbinate enlargement are the very limited space that it has at its disposal for any increase of size and the consequent mechanical difficulties which attend any encroachment upon this space. It is some

abnormality of this body that is responsible for most of the reflex phenomena referred to the nose, and this is because even moderate engorgement of it when it is oversize is apt to bring it in contact either with the septum or the outer wall of the nose, very often both, and to give rise to the pressure symptoms that manifest themselves in such a variety of ways and in such unlooked-for localities.

Besides occasioning the many symptoms of actual nerve pressure, enlargement of this turbinate will obstruct drainage from the superior meatus, and if of sufficient degree will similarly obstruct the outlets of the accessory sinuses. I need not detail the serious results that may follow occlusion of these passages. There is no symptom that is more commonly associated with middle turbinate enlargement than headache. Of course, occasional transient headache may accompany a merely temporary engorgement of the body, of inflammatory or vasomotor origin, sufficient to bring it in contact with its neighboring unyielding walls; but if the ache be persistent, with nothing but brief remissions from time to time, we are apt to find a permanent general enlargement of the body, including perhaps both the bone and its enveloping mucous membrane. The type of pain is that commonly termed neuralgic, and in slightly the larger number of cases it is unilateral. Much stress has been laid upon the diagnostic value of cocaine in these cases, it being stated that the headache is promptly relieved by the local application of this drug. It may or may not be, but the nasal condition is not to be excluded as the possible origin of the headache should cocaine fail to afford relief.

Reference will be made in the article upon hay fever to the great frequency with which some abnormality of the middle turbinate forms the nasal etiological factor in this disease. In asthma also so often is the condition of the nose and particularly of the middle turbinate to be justly suspected of causing the bronchial spasm that no examination of an asthmatic can be regarded

as complete until the nose has been thoroughly investigated. Happily it is becoming less common, though it still happens much too often, for the general physician to exhaust all his remedies in a vain attempt to cure this disease before asking the rhinologist to ascertain if there be any nasal cause for it. In very many instances the removal of polyps, middle turbinate hypertrophies, and septal deflections and spurs has been followed by almost magical cure after months have been wasted upon an utterly ineffectual use of drugs. I need scarcely add to the foregoing list of effects that are apt to follow enlargement of the middle turbinate the fact that the sense of smell will almost always suffer more or less impairment.

In the treatment of these affections of the middle turbinate we may use chromic acid, the snare, a guarded trephine, or some form of cutting or crushing forceps. Owing to the proximity of the structure to the intracranial contents, and in view of the free venous and lymphatic communication between them, the use of the galvanocautery is prohibited. The inflammation following its employment is often too severe to make its use safe in this situation. Chromic acid, however, will prove entirely satisfactory for all of the mucous membrane hyperplasias of ordinary size and consistence, while for the larger mucoid hypertrophies or for the condition known as polypoid degeneration the cold-wire snare is eminently safe and effective.

When, however, the osseous portion of this turbinate is diseased we must resort to something more formidable in the way of an operation. Turbinotomy is not only a perfectly justifiable operation for this condition, but it is the only one that will afford complete and permanent relief. It must be extensive enough to remove every possible source of intranasal pressure. This may be accomplished by a guarded trephine or drill, or equally well by a pair of slender but strong cutting forceps. With the aid of a 6 or 8 per cent. solution of cocaine, followed by the 1 to 4000 adrenalin solution, both pain and hemorrhage are minimized and

the difficulties of the operation greatly modified. After it is completed the fossa is thoroughly cleansed and the upper portion of it then lightly packed with nosophen or other antiseptic gauze. At the end of twenty-four hours this may be removed and the cavity afterward cleansed daily and insufflated with one of the numerous substitutes for iodoform.

In conclusion, a few words concerning the posterior hypertrophies of the inferior turbinated body. Meeting with no resistance to their growth backward into the postnasal space the size attained by hypertrophies in this situation is sometimes enormous. They rest upon the upper surface of the velum, and may interfere very seriously with its freedom of movement. They may exert sufficient backward pressure upon the anterior lip of the Eustachian tubal orifice to interfere with the ventilation of the middle ear, and finally, by obstructing one or both nasal fossæ, they will give rise to all the effects which attend this condition. With the aid of the postrhinal mirror they are not at all difficult of recognition. They are usually rather dark in color, a deep pink or purple, and the surface is commonly roughened or granular. If they are of more than ordinary size they may even be lobulated, and when double may meet in the middle line and quite conceal the septum. They are rather firm in consistence, and the finger-tip introduced through the mouth into the nasopharynx will locate the growth and its attachment without much danger of error. In a nose of average capacity they can also be seen perfectly well by anterior rhinoscopy if the portion of the turbinate anterior to them be reduced by cocaine.

These posterior hypertrophies are not only obstructive, but are capable of producing so many other annoying symptoms connected with the ears, the quality of the voice, and the character and quantity of secretion, that there is no difference of opinion as to the necessity for their removal. They are usually too large to be reduced within any reasonable time by caustics. Of the surgical measures employed the cold-wire snare is probably the

best. The Jarvis instrument I have always found perfectly satisfactory. Preliminary to its introduction into the nose the cavity is well cocaineized anterior to the growth, so that we will obtain not only a good view of but a clear approach to it. A loop of wire sufficiently large to readily slip over the tumor is provided, and this may be kept partly drawn within the canula until it reaches the posterior nares. Being then thrust out to its full size a little patience and manipulative skill will rarely fail to ensnare the tumor. If there should be any difficulty, however, the position and movement of the loop may be watched and guided by means of the postnasal mirror, and the use of this instrument will be facilitated also by employing, in addition, a palate-retractor. Instead of these we may introduce the index finger of the disengaged hand into the nasopharynx and push the loop into position with it. Having encircled it securely it will be prudent, in view of the size and vascularity of the growth, to tighten the snare and sever the tissues very slowly. Hemorrhage is not apt to be at all serious, but it may be very troublesome and may be largely avoided by this slow division of the vessels. Twenty or thirty minutes will not be too long a time to allow for this purpose. Upon the completion of the operation equal parts of antipyrine and boric acid, the former for its hæmostatic effect, may be insufflated upon the base of the growth, and this followed by an oily solution of antiseptics, such as that of Douglas. During cicatrization the nose is to be cleansed daily, but should not be blown too vigorously.

The incandescent instead of the cold wire may be used for snaring these growths, but it has several objections that the latter has not. It requires greater experience for its safe and successful employment; it is more expensive in the equipment that is necessary; cicatrization, owing to more extensive traumatism of the surrounding tissues, is not as rapid, and finally there is greater danger of extension of inflammation to neighboring structures, particularly the tube and middle ear.

3. Atrophic Rhinitis.

Theory has outdone itself in its efforts to satisfactorily explain the origin of this disease. So many more or less opposing theories have been advanced by different observers that if they were all impartially given the student could not but wonder at and be puzzled by such a diversity of opinion. The disease has been attributed to certain peculiarities of conformation of the skull, involving principally the shape of the jaw and hard palate and the dimensions of the nasal chambers. These are found in the broad or flat type of face, that in which the nasal bridge is wide and without prominence, and in which it is usual to have a distended and somewhat upward and forward presenting nostril. These anatomical peculiarities affect adversely the secretory processes within the nose by permitting the passage of an abnormally large quantity of air, and so quickening the evaporation of the fluid portion of the nasal mucus that the remainder thickens and perhaps dries before it can be removed by the action of the epithelial ciliæ. There is indeed almost invariably associated with these conditions a metamorphosis of the epithelium from the ciliated columnar to the flat squamous cell. As to just when this alteration occurs, however, whether early or late in the disease, whether, in other words, it is less a cause than an effect, we are unable as yet to speak positively.

There have been repeated attempts by some few investigators to prove the dependence of the disease upon a specific micro-organism; but these cannot, I think, be said to have been successful. To be sure, we may not deny that the bacillus mucosus ozæna is invariably present, but we are far from admitting at the same time that its etiological relationship to the disease is thus clearly proven. The conditions attending degenerative and atrophic processes within the nose are certainly such as to invite the presence of pathogenic bacteria, and these latter seem much more likely to be dependent upon rather than provocative of the former.

It is believed by probably a large number that atrophic rhinitis is but a late stage of the hypertrophic form. This theory has been presented very plausibly and advocated quite earnestly, but we have been vouchsafed no explanation of those cases, and their name is legion, which have undoubtedly been atrophic from the beginning.

Chronic suppurative disease of one or more of the accessory sinuses has been brought forward as a frequent if not an invariable precedent of atrophic rhinitis, but the previous or even coexistence of sinus disease too often fails of demonstration to enable us to accept this theory.

My own experience strongly inclines me to believe with Bosworth that this disease is an outcome of the purulent rhinitis of childhood. The epithelial instability of early age, its rapid proliferation and desquamation during inflammatory disturbance, the proneness of catarrhal processes to become chronic, to attack the glandular as well as the superficial epithelium, and to eventuate in the serious crippling if not destruction of the glands, are quite enough to precipitate the other pathological events that mark the establishment and progress of atrophic rhinitis.

There are certain factors of a systemic or constitutional nature that undoubtedly strongly favor the birth of this disease, and which subsequently make it resistant to any treatment directed to its cure. A tubercular, syphilitic, or strumous taint will exert quite a marked influence of this kind, and an anæmic condition or one of generally lowered nutrition will have a similar if less noticeable effect.

We must refer, in conclusion, to the frequency with which bad hygienic conditions are associated with this disease. We cannot consider them as causative in themselves, but the fact that the disease is restrained and ameliorated by improvement in the patient's surroundings and by correcting any faults in his mode of life are enough to make it apparent that these matters may play some part in its etiology.

Symptomatology. Of the symptoms, that which is most prominent, most aggressive, and which is responsible for the disease being widely known by the name of this symptom is the odor. *Ozæna* is the term for this, and its use should be strictly limited to its limited meaning. To refer to the disease as a whole by this word is inaccurate and slovenly. We have not yet succeeded in discovering the source of the odor. Whether it be due simply to the decomposition of the organic material within the nose, or to the presence of the *bacillus fœtidus*, is still a matter of conjecture and individual opinion. There is no dispute, however, as to the intensely offensive character of this odor. In the worst cases it is positively sickening, and wholly baffles description. Fortunately for the patient, however, in cases of any standing, anosmia is usually complete, so that it is not he but those with whom he comes in contact who suffer most from this fetor.

The other notable symptoms are the crust formation, the frequent obstruction of the nose by these crusts and the consequent resort to mouth-breathing, the inevitable dryness and irritability of the pharynx and larynx, with ensuing hoarseness and perhaps dry cough, some dull headache, and a much diminished intellectual activity. Gastric disturbance is not at all uncommon, and a generally lowered vitality, though not the rule, is observed in a certain proportion of cases. Inspection of the nasal chambers reveals the tissue change that gives the disease its name. The mucous membrane enveloping the turbinated bones, as well as that covering the septum and the floor of the nose is seen to be shrunken, thinned, and more or less tightly drawn over the underlying structures. Instead of being soft and yielding to the touch of the probe, it is tough and often insensitive. These alterations are usually only to be perceived after the cavities have been freed from the masses of dried mucus that commonly fill them. The crusts are generally very large, and often form complete casts of the fossæ. Their removal is accompanied by a sudden intensification of the stench for which the disease is famous, and beneath

them is usually found a film of semifluid pus. Genuine ulceration is never present. Some small superficial erosions may at times be discovered, but even these are the result of accident (picking of the nose, violent expulsion of the crusts, etc.), and are not a part of the disease proper. When the cleansing of the nose has been completed the abnormal spaciousness of the fossæ becomes apparent. In the more advanced cases, owing to the atrophy not only of the mucous membrane, but of the turbinated bones themselves, the two nasal chambers may be found with almost smooth walls, the normal scroll-like projections of the turbinates entirely absent, so that we have an unobstructed view of the postnasal cavity and can look into the Eustachian tubal openings without hindrance.

Pathology. Whether or not it is causative of the subsequent sclerosis and atrophy of the mucous membrane, is a question that demands further study, but it is a rule with few exceptions that the atrophic process that characterizes this disease is preceded for many months, perhaps even several years, by a chronic purulent catarrh. Instead of remaining limited to the surface, this invades the glands, the epithelium of which undergoes consecutively cloudy swelling, granular and perhaps fatty metamorphosis, and is cast off with greatly increased rapidity. The quality of their secretion is naturally altered by these retrograde changes and is shown in its increased viscosity and tendency to rapid inspissation. The gradual alteration in type of the epithelium throughout the whole cavity has been spoken of—its change from the columnar to the flat squamous cell.

This purulent catarrh is accompanied by the formation of more or less inflammatory tissue in the deeper layers of the membrane, and subsequent contraction of this seriously interferes with nutrition and ushers in the sclerotic change which sooner or later becomes apparent. This is attended by a great lessening or complete suspension of glandular activity. As the disease progresses the simple atrophy of the tissue elements is succeeded by degen-

erative changes, the cells undergoing cloudy or granular change, or fatty metamorphosis. As the result of a rarefying osteitis, the bones also may exhibit more or less diminution in size, and at times almost wholly disappear.

Diagnosis. The history, symptoms, and objective alterations that characterize this disease are so distinct, so unique, that the danger of diagnostic error seems almost infinitesimal. Previous to cleansing of the nose we may entertain the suspicion of nasal syphilis, but as soon as the fossæ are emptied of all foreign material we will discover in syphilitic rhinitis, not a shrinkage and atrophy of the tissues, but a gummatous infiltration of them, and, at a later stage, more or less extensive ulceration. This is usually accompanied by some little hemorrhage, and the crusts and fragments of necrosed tissue are, therefore, apt to be dark and blackish, instead of the greenish-yellow color that distinguishes the dried secretions of atrophic rhinitis. A little experience with these two diseases will also enable one to detect an almost diagnostic difference in the odor attending each. As regards offensiveness, there is perhaps nothing to choose between them, but there is an indescribable something in the fetor of syphilitic necrosis that usually enables the rhinologist to recognize this disease even previous to an ocular inspection.

Principally from a therapeutic point of view it is extremely desirable and important that the student shall not confound a simple dry rhinitis, or, again, a condition termed by Macdonald "vascular collapse," with true atrophic rhinitis. In a limited number of cases we find the nasal mucous membrane deeply congested and more or less swollen, but very dry. There may be a few flakes of inspissated mucus upon the septal cartilage or upon the anterior extremity of the middle turbinate, but there is no accumulation at all comparable to that which is common to atrophic rhinitis. There is, of course, no odor associated with the simple dry rhinitis, but there may be a little epistaxis occasionally provoked by vigorous blowing of the nose or by forcibly remov-

ing from the septum the little flakes of dry mucus that collect there. This type of inflammation is not uncommon in chronic alcoholics, in those who use tobacco to excess, and in those who are guilty of sexual intemperance. It is, therefore, found almost exclusively in adults, and, beyond the mere scantiness of secretion, no analogy can be drawn between this condition and that of true atrophy.

As to the condition described as "vascular collapse," it is simply testimony offered by the nasal mucous membrane concerning a general state. It is not a rhinitis, there are no inflammatory phenomena, and those in whom it is found are not subject to the frequent acute coryzas that occur in atrophic rhinitis. It is simply the expression of a general anæmia, of a state of profound malnutrition which is displayed with marked distinctness in the pituitary membrane. The appearances are such as would naturally be expected to accompany such a condition. The membrane exhibits varying shades of pallor, the turbinated bodies have lost their prominence and are more or less completely collapsed, and this ischæmia of the tissues leads perforce to functional inactivity of the glands and to the dryness the inexperienced observer may regard as indicating atrophic change. The membrane, however, although shrunken and almost empty of blood, is not thinned and stretched over the underlying bone as in atrophic rhinitis, and the turbinated bones themselves retain their natural contour and show no diminution in size. In atrophic disease of any standing, however, the bones will be noticeably reduced in their dimensions, and the enveloping membrane is not infrequently the seat of an irritative hyperæmia which the crusts and mucopurulent secretion do much to maintain. The broad and seemingly flattened nose with wide, uptilted nostrils that is typical of atrophic rhinitis is not found in association with simple vascular collapse, and, oddly enough, the general health of the victim of atrophic disease is to all appearances fairly good while that of the sufferer from vascular collapse is as evidently impaired.

Before leaving this subject, it may be well to take this opportunity of pointing out the different therapeutics of the two diseases. In atrophic rhinitis all our energies are directed to the treatment of the local condition, whereas vascular collapse, being but the evidence of a systemic state, we will treat this latter most attentively and confine our treatment of the nasal condition simply to cleansing washes and protective oils.

There is a bare possibility, perhaps, that chronic suppurative inflammation of one or other of the accessory cavities may be confused with atrophic rhinitis. In disease of these sinuses, however, the discharge is commonly unilateral, there is no crust formation as a rule, the olfactory sense is but slightly if at all impaired, and, consequently, and in contradistinction to atrophic rhinitis, the patient himself is more keenly sensible of the mild fetor associated with this disease than are his associates. The history of the chronic sinusitis is also of decided diagnostic value.

Prognosis. The prospect of cure is dark or bright in proportion to the stage of the disease, to the degree of atrophy and degeneration of the tissues, to the constitutional vigor of the patient, and to his energy in seconding the efforts of the physician to limit crust formation. While it is extremely seldom that we may hope for a veritable cure of this disease, yet we are often agreeably surprised by the closeness with which we can approach such a result. So nearly can we attain this, indeed, that in probably a majority of cases nothing will be lacking a complete cure but the actual regeneration of tissues that have atrophied past redemption.

Treatment. The very keystone of success in the treatment of this disease consists in the *thoroughness* with which any plan of treatment is carried out. The simplest methods may conquer the disease if rigidly observed, the most elaborate may fail if the physician or patient be indifferent or neglectful. There are really but two indications to be met—the first, to obtain and maintain

as nearly as possible perfect cleanliness of the nasal passages ; the second, to improve the nutrition of the starved and wasting tissues. If the first of these indications be fulfilled there will be a more or less complete disappearance of the stench, the most objectionable symptom of the disease, and in proportion as we satisfy the second there will be increased glandular action, return of normal color and moisture to the lining membrane, and a rapid diminution of crust formation.

To secure cleanliness of the fossæ we may adopt one or more of a variety of methods. If we restrict ourselves to the use of washes they may be applied in the form of a fine or coarse spray, by means of a douche or syringe, or they may be simply sniffed into the nose from the palm of the hand. The quantity of wash necessary to effect its purpose is usually so great in this disease, that if the Dobell solution or any of the alkaline tablets that substitute it be used the item of expense will become quite an important and at times a serious one. We will gain in economy, therefore, and lose nothing in practical efficiency if instead of these comparatively costly solutions we employ the normal salt solution. A teaspoonful of table-salt is dissolved in a pint of warm water and used by one of the methods above mentioned. The fine or coarse spray, however, will do little more than merely moisten the incrustated contents of the fossæ, and the most violent subsequent blowing of the nose will usually fail to expel them. The spray, therefore, is practically useless here, and we must resort to something more forcible. The dangers of the douche, with reference to the possibility of its flooding the middle ear, have been so repeatedly explained and firmly established by an almost countless number of recorded cases of injury to this organ that I mention this method only to condemn it. Even were its use confined to our own offices there would still be no necessity and no excuse for taking the risk that its employment involves. It will be prudent to make it a rule to explicitly forbid any resort to it by our patients. In place of the douche we may use with much

greater safety and equal efficiency some form of syringe. There is none better than the soft rubber-ball model, shown in the illustration, Fig. 29. It has a perfectly flexible rubber tip with which a careless or even rough patient can do himself no harm, and for this reason also this syringe becomes the safest and most satisfactory device that can be used in cleansing the nasal passages of children. If the solution be warmed and injected with this with a fair amount of vigor, and perhaps for several minutes at a time, the large crusts will gradually be dislodged, will soften or break down, and may be blown from the nose in fragments. When this has been accomplished a little listerine, euthymol, or borolyptol may be added to the salt solution, and the nose given an additional washing to remove any remaining muco-pus and to suppress any lingering odor.

In a certain proportion of cases the crusts may be of such hardness and tenacity that the syringe fails to loosen them, and to these patients I do not hesitate to give a nasal applicator, show them how to attach the tuft of cotton to it, and then tell them to moisten it with the solution and to detach with it the adherent crusts. There is no necessity to impress upon a patient of the most ordinary intelligence the need of gentleness in doing this. I have not found that people are apt to inflict upon themselves any pain or injury that can be avoided.

In our own offices the method of cleansing the nose, though more thorough, differs only in trifling details from that which is pursued by the patient at home. We use an alkaline solution to moisten and soften the crusts, we remove the larger ones with a pair of angular forceps, while the smaller and more firmly adherent ones are gently rubbed from off the atrophic membrane by the cotton-tipped applicator. This latter instrument should be carried into every little nook and cranny of the three meatuses, and not a shred of mucus, dry or moist, be left to prolong the irritation and to maintain the mucopurulent discharge. The surface of the membrane should be really scrubbed with this wet pledget of

cotton, the friction itself having an appreciably stimulating effect upon the nutrient vessels. The nasal fossæ being now well cleansed we extend our attention to the nasopharynx, and do not lay aside our spray and cotton-carrier until we have brought this to the same state of sanitary purity that we have the nose. I do not advocate the use of the postnasal syringe. I have already mentioned my objections to it, and there is, moreover, not the least necessity for its use in this disease. The abnormally wide nasal fossæ permit an almost unobstructed view by anterior rhinoscopy of the walls and vault of the nasopharynx, and there is not a section of their surface that cannot be easily reached by the nasal applicator.

The nasal and postnasal cavities having been now prepared for medication, we have at our disposal a bewildering number of remedies from among which to make a choice.

Let it be always remembered, however, that the remedy selected is of minor importance. It is upon the preliminary cleansing of the cavities and the thoroughness with which the medicament is subsequently applied that the measure of our success or failure will depend. Instead, therefore, of giving a long list of agents, each of which is regarded by those who use it as superior to all the rest, I shall detail a plan of local treatment that may be closely followed or varied as widely as may seem desirable. At our patient's first visit the washing process may be followed by a generous spraying with the Boulton solution, page 88. This is directed into each separate meatus, sniffed by the patient back into the nasopharynx, and afterward the same solution, by means of the cotton-carrier, is gently rubbed into the mucous membrane throughout its whole extent. The immediate effect of this treatment will be to produce a temporary capillary dilatation, the pallid mucous membrane will become somewhat flushed and perhaps slightly swollen, serous secretion will be stimulated, and crust formation, instead of immediately recommencing, may be delayed for some hours. The next day, and for

the first week the patient's visits should be daily, the Boulton solution may be supplanted by the first of the three iodine formulæ that have been given, page 115. The effect of this is similar to that of the Boulton, but more marked and of longer duration. The moderate friction with which it is applied contributes to its stimulating action, and it will not be long before the mucous membrane will exhibit the results of improved circulation and nutrition. After a period of varying length a point will be reached at which the membrane fails to respond as distinctly as at first to the energizing influence of the first iodine solution. The second may now be brought into action, and if this be used with proper thoroughness and frequency, it will be but seldom that even the most advanced case will need one of greater strength.

Under this treatment those tissue elements which have not suffered more than a simple atrophy, which exhibit as yet no degenerative change, may gradually be restored to their original functional vigor. We should strive, indeed, to produce an actual hypertrophy of them, so that they may take up, in addition to their own, the work of those portions of the tissue that have passed beyond the possibility of regeneration. We cannot expect to accomplish this in a few weeks or in advanced cases in even a few months, but perseverance on the part of the physician and conscientious co-operation on the part of the patient will ultimately produce results that will fall little short of complete and permanent cure. In proportion to the rapidity of his progress the frequency of the patient's visits may be lessened, but he should be repeatedly cautioned not to relax his own exertions to maintain the improvement that each treatment effects.

An exposition of the treatment of atrophic rhinitis would be incomplete without some reference to several other methods than the one just detailed.

In view of the very scanty secretion in the atrophic nose, and of its rapid inspissation as a result of the greatly widened fossæ,

certain measures of a mechanical nature have been resorted to, both to increase the quantity of secretion and to retard its drying. For these purposes, Gottstein devised the plan of introducing within the nasal fosse tampons of non-absorbent cotton-wool sufficient in bulk to entirely fill the wide lower meatus. The presence of this foreign material not only stimulates an increased flow of secretion from the mucous membrane, but it preserves the fluidity of this secretion by reducing the quantity of air that is permitted to pass through the chamber. I have known several patients whose comfort has been so greatly increased by the use of these plugs that they have chosen to discontinue all other treatment. Greville Macdonald suggests a variation of this plan, which is to merely obstruct the entrance of air into the nose by inserting in the nostril a species of respirator that materially lessens the calibre of that passage. His idea is to lower the barometric pressure within the nasal cavities by this means, to produce, in other words, a partial vacuum, and thus to induce a dilatation of the vessels that supply the walls of this vacuum. That the theory is well founded and of practical value is demonstrated by the number of people whom he has greatly benefited by this method.

The unfortunate feature of these procedures, however, and that which interferes with their more frequent adoption, is the trouble, slight as it is, that their employment occasions the patient and the consequent difficulty of inducing him to be faithful in their use.

Among the radical measures that have at times been advocated have figured the curette and the galvanocautery. Whatever the supposed mechanism of such remedies may be nothing can be more dangerous or unjustifiable than the resort to any means which can possibly result in further injury to the already enfeebled tissue.

Through its employment by a method termed vibratory massage we are assured that electricity is of extraordinary curative

value in this disease. The apparatus necessary for its application in this way, however, is quite elaborate, and the amount of time required by the treatment is so great that few patients and fewer physicians can afford to give it. Another means of using the electric current is by its direct application to the nasal mucous membrane. Either the constant or the interrupted current may be used, and they are said to stimulate tissue nutrition very noticeably. A final method of electrical treatment is found in that known as interstitial electrolysis. This also has met with cordial praise, and many instances of its beneficial effects have been published, but the same objection lies here as against the other electrical methods--the time limitations of the active specialist and the unwillingness and inability of the average patient to incur the expense of such prolonged treatment.

But a word in passing need be given to the use of antitoxin. It was suggested as a therapeutic measure in this disease because of the fancied identity between an organism frequently found in the atrophic nose and an attenuated form of the diphtheria bacillus. It was quite extensively used for a time, and with much reported success, and its advocates seemed to think they had discovered a specific; but impartial observers failed to see that it was any better than a score of already tried and discarded remedies for which similar claims had been made, and it has like them gradually fallen from favor.

It only remains to speak of some few other drugs that have achieved a greater or less degree of popularity in the treatment of this disease.

Formaldehyde, of comparatively recent introduction as a remedy for atrophic rhinitis, is in many cases exceedingly useful. As an antiseptic and deodorant its power is well known, but it must not be forgotten that it is also capable of being an active irritant. In beginning its use, therefore, a solution of 1 part to 5000 is none too weak, and as the membrane gradually becomes tolerant of it this strength may be cautiously increased to 1 to 500. It

may be used twice daily in the atomizer, and previous to its application the nose is of course to be thoroughly cleansed. The ozæna is quickly diminished by this remedy, and its stimulating effect upon the circulation and nutrition may possibly result in its permanent relief.

Ichthyol has been used quite extensively during the past several years with apparently very favorable results; 5 per cent. to 20 per cent. solutions in water or petroleum oils are the strengths employed, and the remedy is rubbed into the mucous membrane with some vigor. Its odor is not particularly pleasant, but as compared to that of the disease itself it is a delightful perfume.

Menthol will probably always be used in the majority of cases, either as the principal medicament or in association with some others of greater activity. The stronger the solution employed the more prompt and noticeable will be its effects, but although much higher percentages may be used as the nose becomes accustomed to it a 2 per cent. solution is quite strong enough to begin with. Benzoinol, albolene, or some other one of the petroleum oils will make the best solvent. Shortly after commencing its use there will be an appreciable improvement in the color of the membrane, the secretion will become more fluid, and crust formation and odor much less pronounced. It may be applied with almost equal efficiency either by the atomizer or by means of the cotton charged applicator.

Numerous, almost innumerable, other remedies have been brought forward from time to time, and perhaps have been regarded for brief periods as improvements on those that have preceded them; but in almost every instance the conclusion ultimately reached has been that the value of any remedy lies less in itself than in the thoroughness and vigor with which it is applied.

While the particular constitutional fault that has an etiological bearing upon this disease may often be elusive and difficult of recognition, yet we may be very confident, I think, that one is

always present. It is wholly incredible that a disease of such gravity and one so rebellious to treatment can be originated and maintained by merely local causes. Whether it be a tuberculous, syphilitic, strumous, or gouty taint, therefore, or apparently only a condition of simple anæmia, we must never for an instant forget this feature of the disease in our therapeutic struggle with it. Everything that can exert a depressing effect upon the patient's general nutrition and vitality must if possible be banished. His diet, clothing, and bathing should receive our careful attention, and, above all other hygienic measures, exercise, hard and persistent, both in and out-of-doors, should be insisted upon. There is nothing that will invigorate digestion, the circulation, every detail of the nutritive process in every part of the body like exercise, and I have found it an absolute *sine qua non* to successful treatment of atrophic rhinitis. The patient is not to be content with walking a few miles every day, but immediately upon rising he should spend fifteen or twenty minutes in earnest work with clubs, dumb-bells, or chest-weights, and follow this by a cold shower or salt-water plunge. A brisk rub-down with a coarse towel or flesh-brush will bring the blood leaping to the surface and to every remote corner of the body, and the patient will be well prepared for a generous and wholesome breakfast. This sort of exercise should be repeated in the late afternoon or just before retiring, and a hot bath and scrub at least twice a week at bedtime will keep the skin from being embarrassed by accumulations of waste material. To be sure, all this requires more time than is consumed in taking a pill or swallowing some bitter tonic, but it is infinitely more beneficial in its effects, and if the patient be unwilling to rise a little earlier in the morning or to curtail some useless pleasure in the afternoon or evening for the sake of this invaluable therapeutic measure his co-operation in other channels will probably be of a weak-kneed variety, and he will scarcely be a promising subject for ultimate cure or even material improvement.

For those whose circumstances permit it some change of climate will often result in a marked amelioration of this affection, but the new locality should be selected more with an eye to its adaptability to the systemic dyscrasia or inherited constitutional taint present than to the local pathological condition. For those of syphilitic or strumous antecedents the seashore is usually preferable, while for those who inherit a tuberculous or gouty taint some inland or mountainous region would be the judicious choice.

4. Specific Inflammations of the Nose.

Syphilis.

The occurrence within the nose of the primary lesion of syphilis is one of extreme rarity. In the majority of cases that have been reported the infection has been carried to the nose upon the finger. The margin of the alæ or the interior of the vestibule are the points where the chancre is most likely to be found. Previous to any secondary involvement of the glands one's suspicions are not apt to be aroused, and the sore may be regarded as an ordinary furuncle, to which it is for a time not at all dissimilar. With the development of distinct induration, however, and enlargement of the facial and cervical glands the real nature of the sore should no longer be a matter of doubt.

The secondary lesions of the disease, though by no means of frequent intranasal occurrence, are yet much more common than the primary. Their appearance is usually coincident with those of the skin. The one most often observed is an obstinate coryza of subacute type. It is very insidious in its onset, not at all demonstrative in its progress, and is characterized by a secretion that is viscid and rather scanty. These, together with the facts that it is so prolonged and so little influenced by the ordinary local and general measures employed for simple acute rhinitis, are about the only features that distinguish it from a coryza of innocent origin. Papulæ or mucous patches are also occasionally

found within the nasal passages, but are apt to fail of recognition unless it be discovered from other signs that the patient is a syphilitic. They usually occur just within the inner margin of the vestibule, upon the septum, the floor of the nose, or upon the turbinated bodies. The patch is slightly elevated, irregularly round or oval, and its edges are apt to be somewhat indistinct. There is but little secretion from its surface, and this is usually rather thick and perhaps slightly purulent.

In early infancy the manifestations of hereditary syphilis are most often of the secondary type, and may be of such severity as to threaten the child's life. Its general vitality will be poor to begin with, and when this is further depressed by a syphilitic coryza that will completely occlude the nose, and by thus interfering with nasal respiration seriously interfere with the act of suckling, we have a condition that is full of menace. The tertiary stage of the disease as it is manifested within the nose is the one of by far the greatest importance, because it is often dangerously virulent and destructive.

Gummatous infiltration may occur at any point within the nasal fossæ, but it exhibits a noticeable predilection for the septum and the external walls. It may be circumscribed or diffuse. If allowed to progress the infiltration becomes so dense that nutrition is seriously interfered with and central softening and necrosis occur. It is to be observed that the bones and cartilages may at times be destroyed through a periostitis or a perichondritis and the mucous membrane remain almost intact. Of the septum it is the bony portion, the vomer and ethmoidal plate, that is most frequently attacked, and its destruction is often extensive and at times complete. The turbinate bodies are almost always included in the infiltration and subsequent necrotic processes, and these also are apt to suffer partial or total destruction. Likewise the bony floor of the nose may be the site of gummatous invasion, and upon the supervention of necrosis we have a more or less extensive perforation resulting which communicates with the

mouth. So rapid and widespread may be the destruction effected by this disease that within a very few weeks all of the intranasal structures and perhaps even the external nose itself may have sloughed away, leaving nothing behind them but a cavern with ragged entrance and suppurating walls. Following or rather accompanying the cicatrization of syphilitic ulceration there is always a great deal of contraction of the tissues that have been involved in it, and this phenomenon, in conjunction with the destruction of the mucous membrane, skin, cartilaginous and bony tissues, leads to alterations so frightfully disfiguring that no other disease, except perhaps lupus or malignant ulceration, can duplicate them.

The interval that elapses between the infection and the appearance of the late or tertiary lesions of the disease may vary from one to a dozen, fifteen, or even more years. Their mode of onset may be abrupt and intense, or it may be extremely insidious and for some time scarcely noticeable. The margin of the infiltrated area is apt to be more or less distinctly defined from the surrounding tissue, not only by some degree of elevation, but also by some appreciable difference in color. The ulcerative process may extend from the surface to the deeper tissues, or it may originate beneath the surface and make its way upward. Its lateral extension is always preceded by the characteristic infiltration, and this is usually accompanied by more or less collateral œdema. The commonest deformity resulting from syphilitic disease, and one the frequency of which endows it with some diagnostic value, is the so-called *saddle-nose*. This consists in the sinking of the bridge of the nose, the simultaneous elevation of the tip, and the apparent broadening of the whole structure. The loss merely of the cartilaginous portion of the septum, nor indeed of the vomer also, will not be sufficient to occasion this significant alteration of form. The support of the nasal bones is derived from the anterior portion of the perpendicular plate of the ethmoid, and it is the destruction of this that is essential to their fall. It will be

important to remember, however, that this type of deformity is not pathognomonic of specific disease. The sclerotic tissue changes of atrophic rhinitis when it occurs in early childhood before the nasal skeleton is firmly knit may be accompanied by quite a marked depression of the bridge, and of course trauma, either directly or through the medium of an ensuing periostitis, may have a similar effect.

Diagnosis. The immediate recognition of this late form of the disease and its energetic treatment are so extremely important that one should be thoroughly familiar with the diagnostic points. The gummatous invasion of the intranasal tissues is almost always accompanied by some dull red discoloration of the skin externally and by some tenderness. Rhinoscopical inspection shows the process to be at first mostly unilateral, the swelling to be dense and resistant, with perhaps an area of softening; it is entirely unaffected by cocaine, and the discharge is a glairy mucus, stained at times by a little blood. Later, when the devitalized tissues break down, the discharge becomes more bloody and contains fragments of necrotic tissue and bone. The blood mingling with the mucus forms large dark crusts that completely fill one or both nasal chambers. When these are removed the more or less extensive ulceration is uncovered, and the gentle use of a probe will reveal denuded and disintegrating bone. The stench is every bit as intolerable as the ozæna of atrophic rhinitis, but there is a slight difference in the odor that will of itself enable the trained nose to distinguish between the two diseases. The turbinated bones may loosen and be extruded in large fragments, or indeed almost complete, but the process of detachment is usually slow and sometimes occupies many days or perhaps several weeks. During this time the condition of the untreated patient is pitiable. The nose is filled with rotting crusts, with foul sanguinolent pus and sequestra; and the head, the eyes, and the ears all ache in unison.

Even without the valuable aid of a history there should be but

little difficulty in distinguishing this disease from lupoid or tuberculous ulceration within the nose, or from atrophic rhinitis. Intranasal lupus or tuberculosis is almost always secondary to manifestations of one or the other disease upon the face. It is in the young also that we most commonly meet with the lesions of these affections. The tubercular ulcer is usually somewhat round or irregular in shape, and its favorite situation is upon the cartilaginous septum or the inferior turbinates. It is sluggish, very slow in its progress, and differs widely in this respect from the often virulent activity of the specific lesion.

In case of any lingering doubt, the therapeutic test should be instituted at once, and this will usually very promptly dispel any diagnostic uncertainty.

The stench and the first glance at the crust-filled fossæ of atrophic rhinitis may arouse a momentary suspicion of nasal syphilis, but thorough cleansing of the atrophic nose will disclose an intact mucous surface and nothing that could be mistaken for a gummatous infiltration. There can scarcely be any misleading resemblance between the pale and shrunken membrane of atrophic rhinitis and the infiltrated, œdematous, and necrosing tissues of late syphilis.

Treatment. Local and constitutional treatment should enter into an active alliance if we would promptly control the progress of this disease. At certain periods and in the presence of certain conditions we may experience some doubt as to whether to resort to mercury or the iodides, or both. The rules laid down by Massei for our guidance under such circumstances may be safely and profitably followed in the large majority of cases. These are :

1. Mercury (*a*) for secondary manifestations; (*b*) when the patient has had no previous mercurial course; (*c*) when the iodides are poorly borne.

2. Iodides (*a*) for the tertiary lesions; (*b*) in those who have already been subjected to sufficient mercurialization; (*c*) when mercury is found to be inactive.

3. Mercury and the iodides in combination (*a*) when there is extensive infiltration and necrosis is rapid, or when either drug alone proves of feeble effect.

4. Mercury to be administered internally in cases of only ordinary severity, but by inunction or intramuscular injection in those where the stomach is rebellious or where there is great haste to get the patient well under the influence of the drug.

In using the drug by inunction the patient should be ordered an ounce of the officinal ointment or of a 5 per cent. or 10 per cent. ointment of the oleate, and this he can divide for himself into eight or ten equal parts. After a hot bath and thorough scrubbing one portion of the ointment should be rubbed into the skin at some part of the body where it is thin and where absorption will be active. The inner surface of one thigh may be first selected and on the following night the other. Then we may go in succession to the inner surfaces of the arms, the sides of the chest, or the skin of the upper abdomen. Every third or fourth night the hot bath and scrubbing should be repeated.

For administration by the mouth the protoiodide is probably the most generally acceptable and satisfactory form. One of the granules containing a third of a grain may be given at first after each meal, and every other day this dose may be increased by one or two, according to the tolerance of the patient. Diarrhœa may be restrained by small doses of tincture opii camph., but when tenderness of the gums on closing the teeth smartly manifests itself the maximum dose has been attained. Depending on the susceptibility of the patient, this may vary between two and four grains per day, and when this limit of tolerance has been reached the dose should be diminished by about one-third, and this quantity continued until and for some time after the entire disappearance of the symptoms.

In the tertiary or late secondary stages of the disease, when the iodide of potassium is indicated it may be given either alone or in association with the bichloride of mercury. Ten or fifteen

grains of the iodide, three times a day after meals, will be a sufficient initial dose, and this may be rapidly increased until the patient is taking three or four drachms in the twenty-four hours. It should never be given on an empty stomach, and should always be well diluted. If in spite of these precautions the stomach should rebel against the administration of such doses as may be found necessary to control the disease, we may frequently succeed in making it acceptable by giving in combination or in conjunction with it a reliable essence of pepsin. The 100 per cent. or saturated solution of the iodide in water may be used, and a sufficient number of drops of this, each representing a grain of the drug, may be added to two drachms of the essence immediately before taking. It is very gratifying to observe the unusual tolerance of the stomach for the iodide when it is given in this way.

The local treatment of the syphilitic nose is of almost equal importance to the constitutional treatment of the disease. If it be properly and thoroughly carried out it will be of very material assistance in promptly arresting the progress of the disease and in averting a great amount of destruction that would otherwise occur. Frequently repeated cleansing is, of all things, most essential. If it be our lot to encounter an infecting chancre in this situation, peroxide of hydrogen will be of service in removing all pus and sloughing tissue from the surface, and it may then be dusted with iodoform or one of its less offensive substitutes—aristol, nosophen, or europen.

The rhinitis of secondary syphilis is to be palliated by the same measures that afford relief in the simple acute catarrh of the nasal mucous membrane. The alkaline spray followed by one of the distilled extract of hamamelis, one part to three of water, and this, finally, by an albolene or benzoinol spray containing five or ten grains of menthol to the ounce. Beyond lessening somewhat the discomfort attending the inflammation this will have but little effect in shortening its duration. It is the constitutional

treatment alone that can exert any actually curative influence. There may be some disposition to resort to solutions of the mercuric chloride to combat this specific coryza, but even when of feeble strength these are apt to prove irritating to the pituitary membrane, and it is to be remembered that they will form an insoluble albuminate of mercury with the nasal secretions. The mucous patch, after the fossæ have been well sprayed with the ordinary alkaline solution, may be mopped for a few moments with hydrogen dioxide, and then, having been dried, should be lightly and accurately touched with silver nitrate fused on the probe or with a 1 to 10 solution of nitrate of mercury. Care should be exercised that these applications do not include any of the surrounding tissue. The treatment may be completed by a thin coating of aristol or nosophen.

It is in the treatment of the rapidly destructive tertiary lesions that all our energy and skill will be demanded for their control and cure. Not a moment should be lost in ridding the fossæ of every crust, all hopelessly necrosed tissue, and any detached sequestra. Prior to its removal the mass of offensive material had better be softened by the use of the Dobell solution in the Birmingham douche or in the rubber-ball syringe. A quantity of this fluid is injected into the cavities and retained for a few minutes the patient the while having his head thrown back and conducting breathing through the mouth. When sufficiently softened the larger crusts may be extracted with a pair of angular forceps, and then the smaller ones and all mucus and pus mopped out with the cotton-carrier. Although some loosened sequestra may be present, they may be of such size that their immediate removal cannot be accomplished without extensive laceration of the tissues. In such case it will, as a rule, be much better to wait a few days until the infiltration and inflammatory swelling have diminished somewhat and given us more room in which to work them out. The use of cocaine and suprarenal extract will add still more to this very desirable space, and at the same time

lessen pain and possible hemorrhage. If, however, in spite of increased room the pieces of dead bone are found to be too large for removal through the natural openings, we should attempt to crush them into smaller fragments by means of strong forceps. When the nose is finally freed from all loose necrotic tissue and secretion it will often be found of still further advantage to use the curette. With this instrument all flabby and unhealthy granulations should be carefully scraped away, the slough-covered margins of the ulcerations cleaned, and so put in much better condition for rapid improvement under the influence of topical applications. The peroxide of hydrogen will assist very materially in this work of preparing the surfaces for local medication. Having them thus prepared, a drachm to the ounce solution of silver nitrate will be found an efficient application. This is to be lightly brushed over every ulcerated area within the fossæ by means of the applicator carrying a small tuft of cotton. There is no occasion to use the galvanocautery or the acid nitrate of mercury, since these are unnecessarily violent in their action and possess no advantage over the silver. The local treatment may be concluded by an insufflation of aristol, nosophen, or eucophen, but if the objections of the patient can be overcome, iodoform will be found more satisfactory than any of these. An excellent combination in which it may be used for this and other ulcerative lesions within the nose is :

R. Iodoform,							
Acid. tannic.	.	.	.	.	.	ââ	3 ss.
Bismuth subnit.,							
Pulv. acaciæ	.	.	.	.	.	ââ	3 ij.
Morphinæ sulphat.	.	.	.	.	.		gr. xx.—M.

It need scarcely be added that this thorough cleansing and medication should be repeated daily until any extension of the ulceration is checked and cicatrization is well under way.

We should never permit, however, our interest in the local lesions to lead us into any neglect of the patient's general condition. Mercury and potassium iodide should be ordered at once,

and, in addition to its internal administration, the former may be used by inunction or intramuscular injection. The specific action of mercury consisting in the fatty degeneration which it occasions in the plastic and unstable products of syphilis, it follows that the general health should be raised to the highest limit in order that the elimination of these effete materials may be hastened as much as possible.

In case the external nose is threatened with depression or other deformity as the result of extensive destruction of the intranasal structures, some prosthetic appliance should be used to prevent this. No two cases being alike the physician's own ingenuity must be called upon to provide the best means for securing this end.

Tuberculosis.

Nasal tuberculosis is never primary, but is always associated with and secondary to the pulmonary disease. Its favorite seat is the septal cartilage, and it manifests itself in a variety of ways. The most frequent is a broad based, irregular swelling upon the septal cartilage, commonly unilateral at first, but later, as a rule, appearing on the other side. So far from showing any signs of inflammation the mucous membrane is grayish rather than red, and its appearance is somewhat suggestive of a septal abscess. The surface at times is nodular. Round-celled infiltration of the perichondrium ultimately occurs, the nutrition of the cartilage is cut off, and the necrosis and breaking down of this structure leads to a coalescence of the previously distinct tumors. Although the mucous covering may remain intact for a long period, yet the final result is usually ulceration and more or less extensive destruction. When complete perforation of the septum is at last accomplished we find the opening rimmed by typically tuberculous granulations, and these will distinguish it from the simple perforative ulcer of the septum, which is clean-edged and quite smooth.

In addition to the above described lesion we have another which is almost from the beginning ulcerative. The septal cartilage is again the usual site for its occurrence, although it not uncommonly extends to the adjoining structures. There is a moderate preliminary infiltration of the mucous membrane, shortly followed by epithelial necrosis and slowly progressive ulceration. There may be occasional slight attacks of epistaxis accompanying this; crust formation is almost limited to the site of the ulcer, and the mucopurulent discharge incidental to it is by no means copious. Inflammation of the contiguous mucous membrane is conspicuous by its absence, and if this of itself fails to dispose of the suspicion of syphilis we have but to examine the chest to find there, almost without exception, more or less extensive disease of the lungs.

The treatment of these lesions consists in the mechanical removal of all necrosed and diseased tissue. This may be accomplished by means of the curette, and a 30 per cent. to 50 per cent. solution of lactic acid may then be rubbed into the base of the ulcer with excellent effect. Or, instead of this, the galvanocautery may be used to bring about cicatrization. In either case an insufflation of iodoform will serve as an appropriate dressing for the wound. We may utilize the removed material for confirming our diagnosis by examining it for and discovering in it the tubercle bacillus.

Lupus.

A very few cases of primary nasal lupus have been reported, but with rare exceptions the disease is secondary to lupus of the contiguous facial integument. It extends within the vestibule from the margin of the alæ or the nasolabial fold, and then invades the nasal chamber proper. The mucous membrane of the septum, the lower turbinates, or the floor of the nose is first attacked, and, as the disease slowly progresses, the underlying bony or cartilaginous structures may become implicated and de-

stroyed. Except upon the septum, however, the ulcerative destruction is usually limited to the mucous membrane, and as the contraction which ensues upon cicatrization occurs we are apt to have a variety of deformities, of which stenoses are the most frequent result. The absence of pain is one of the most striking features of the disease, and it is this which explains most plausibly the almost habitual procrastination of these patients in presenting themselves for treatment, this being practically identical with that of the tubercular ulcer.

Leprosy, glanders, actinomycosis, and rhinoscleroma are so rare as to be of scarcely more than literary interest.

CHAPTER VI.

NEUROSES.

HAY FEVER.

THIS disease is classed among the neuroses for the reason that its principal phenomena are the result of a temporary suspension of vasomotor nerve control over the vessels of the nasal mucous membrane. Its exciting cause is an atmospheric irritant, usually some variety of vegetable spore, its predisposing causes two in number, the one local, the other systemic. The first of these is a special hyperæsthesia or susceptibility of the pituitary membrane to the disturbing effects of certain foreign materials that are inhaled with the air. In the vast majority of cases this is largely due, no doubt, to some perfectly evident intranasal abnormality—a simple chronic catarrhal or hypertrophic rhinitis, the presence of polyps, a deflection of the septum, or a cartilaginous or bony spur from it of sufficient prominence to bring it at some or at all times in contact with the opposing middle or lower turbinates. Such conditions are certain to be accompanied by more or less hyperæmia, and this, of course, involves a proportionate amount of hyperæsthesia.

The systemic predisposing cause is temperamental or diathetic, or both. Ever since the disease was first systematically investigated the nervous temperament has been regarded as the chief if not the only constitutional factor. It is not to be denied that it is present in a very large proportion of the cases, possibly more than half of them, but in the rest it may be either entirely absent or so indistinct that it may be justly ignored. Indeed, I would limit the class of neurotics to those only who clearly inherit their nerve instability. In the others this cannot be said to be a matter

of temperament, but is merely secondary to or is the outgrowth of some diathetic state that is rooted in defective nutrition. Whether we term this lithæmia or the gouty or uric-acid diathesis is immaterial, the essential fact being that some disturbance of normal metabolism results in a persistent poisoning of the blood current. At the very moment that contamination of the blood occurs there is inaugurated an increasing irritation and a steadily diminishing stability of the reflex nervous centres. The vasomotor centres are early affected, and when their loss of equilibrium is added to a long precedent nasal lesion that has rendered the pituitary mucous membrane particularly intolerant of any form of irritant, we have but to await the floating of some variety of pollen into the nostrils to witness the speedy evolution of this disease. According as it occurs at different seasons of the year it is known by different names. In the early summer we hear of it as June cold, vernal catarrh, rose cold, and later on toward the middle or latter part of August it is more frequently termed autumnal catarrh, hay fever, hay asthma, or rag-weed fever. The fact that several of these names are derived from the different plants or flowers that supply the irritant suggests that it is not always the same variety of pollen that provokes the attack. And this is, indeed, the case. A certain plant or weed that may be intensely disturbing to one individual may be quite inoffensive to another. No age is exempt from the disease, and the sexes are about equally affected.

Symptoms. It is scarcely necessary to rehearse the distressing symptoms of this disease. It is far too common during the summer months in this country for any of us to be entirely unfamiliar with the clinical picture that it presents. Many of those who are sufferers of some standing develop a partiality for some particular day on which to commence each annual attack, and this is especially apt to occur in those who present a well-defined neurotic tendency. The invasion of the disease is at times almost explosive in its abruptness, a single hour often sufficing to land

the victim in the very midst of his woes. As a rule, however, for a few days preceding the actual onset the patient is conscious of some itching in the roof of his mouth or at the inner canthus of the eye, and the nose, as well as the eyes, is more sensitive to anything of an irritating nature. The torments of the fully developed attack must be experienced to be fully appreciated. The profuse and acrid rhinorrhœa, the violent paroxysms of sneezing, the usually complete occlusion of the nose, the photophobia, the copious lachrymation, the swollen and burning eyelids, the enforced mouth-breathing with its attendant parched throat and frequent, dry cough—is not all this enough to make the sufferer an object of deep compassion?

Inspection of the nose reveals the turbinates distended to their utmost capacity and packed up against the septum, not brightly hyperæmic as in simple acute rhinitis, but œdematous and often of a waxy pallor. They are almost constantly streaming with a thin, serous secretion, and the margins of the alæ are reddened and excoriated. A very few days of this sort of thing would be bad enough, but when it is prolonged over six weeks or two months it is not surprising that the physical condition of these unfortunates is usually very much reduced.

Diagnosis. There should be no difficulty in arriving at this promptly. The violence of the symptoms, the season of the year, the appearance of the nasal tissues, and a history of previous similar attacks furnish us with enough evidence to prevent any blunder.

Prognosis. The disease is curable, but cure depends not alone upon the judicious selection of and perseverance in treatment by the physician, but almost equally upon the conscientious co-operation of the patient.

Treatment. That of the attack is no more than a struggle to lessen its severity and duration. Believing as I do that uric acid is in excess and that the blood contains other toxic impurities of intestinal origin, all of which contribute to its irritating qualities

and to its disturbing effect upon the vasomotor centres, my first effort is of an eliminative nature. One of the natural laxative waters, particularly one containing a large proportion of phosphate of soda, is used upon rising each morning. An abundance of pure water is ordered for consumption throughout the day, a half-gallon is none too much, and the nitrogenous elements of the diet are reduced to a minimum. Hot baths are employed at bedtime and a cold sponge douche to the spine in the morning. Those who can afford it may be benefited by the addition of general massage two or three times each week, and those who cannot should daily indulge in light indoor exercise, stopping short of the point of fatigue. Drugs are of minor value during the active period of the disease, and if quinine, belladonna, or any others of the large number that have been proposed are used, it should only be after the gastro-intestinal tract has been emptied and the blood somewhat relieved of its organic impurities.

As to local treatment, this also will be rendered the more efficacious by a systemic rinsing so thorough that the measures adopted for local relief will not be antagonized by internal irritants. The first step toward securing a mitigation of the nasal symptoms will be the cleansing of the fossæ. This cannot be satisfactorily carried out so long as the engorged and œdematous condition of the turbinates obstructs the entrance of our sprays. These swollen bodies must, therefore, be first reduced, and we are now blessed in having in cocaine and the suprarenal extract a pair of remedies that for this purpose are infallible. A 2 per cent. cocaine solution is first sprayed upon the anterior extremities of the turbinates, and when the very slight contraction obtainable from this drug alone has been secured the same solution may be applied, by means of the cotton-carrier, slowly and in the gentlest way to every accessible portion of the cavity. In two or three minutes the sensibility of the mucous membrane will have become less extreme, and the Dobell solution, warmed, should then be freely sprayed into the slightly opened meatuses. As much as possible

of this being sniffed back into the nasopharynx, the nose is then vigorously not violently blown, and thus freed from both wash and secretion. We are now ready to profit by the astonishing vasoconstricting powers of the suprarenal substance. This is most efficiently employed in a 10 per cent. solution, and this solution is more active and less liable to prove irritating if freshly prepared. After filtering it may be used in the atomizer if one chooses, but I think it more energetic and prompt in its action if it be brushed over the membrane by means of the applicator with its tuft of cotton. Within the space of a minute the previously inert, palsied vessels will have contracted, and a remarkable amount of turbinate shrinkage will have occurred. The patient experiences the delight of free nasal respiration, and is assured at least of an hour's respite from the worst features of his malady. Once again is the warm Dobell solution now used, the nose blown and dried with absorbent cotton, and then one, two, or more of the offending turbinates are lightly touched in two or three spots with chromic acid. This may seem a rather startling therapeutic measure, but there are several reasons for its employment. In the first place, although it is seemingly an additional irritant to the already incensed membrane, yet it is to be remembered that the condition present is not one of simple inflammation, but is wholly the result of suspended vasomotor inhibition. This has been brought about through the specific influence exerted by some variety of pollen. It is not an ordinary irritation, its effects being dependent upon an idiosyncrasy afforded by the patient. The condition then is one of complete vascular relaxation, and the action of chromic acid at this juncture is that of a tonic stimulant rather than an irritant. I repeat that its application is to make scarcely more than a speck upon the membrane, and if its use is carefully limited to this there will not only be no noticeable increase of the patient's immediate discomfort, but within a few hours a material contraction of the distended turbinate will have occurred, the secretion will be less profuse, and the par-

oxysms of sneezing will be neither as frequent nor violent. This pin-point application of chromic acid occasions no destruction of tissue, and it may be repeated, therefore, at intervals of a few days without hesitation and with increasing benefit to the patient. It is not unlikely that its stimulating and indeed tonic effect may be central as well as peripheral. Shall we place cocaine in the hands of our patients for their personal use? As a rule, I should say emphatically No! But there are a few exceptional instances of intense and continuous suffering, the patients being people of intelligence and evident strength of character, to whom the drug in 2 per cent. solution may be given with instructions that it be used only at certain times and in very limited quantity.

The foregoing reference to cocaine and its personal employment by the patient was written before I was as familiar as now with the vastly greater potency of the suprarenal extract. And while I have nothing to retract or modify in what I have said of cocaine, its action as compared to that of the adreanal substance is feeble and inconsequent. The glandular extract has a very great additional advantage in being entirely non-toxic and quite incapable of establishing any vicious habit. The patient may be shown how to prepare his own solution extemporaneously with the powdered extract, or he may employ the solution prepared by Parke, Davis & Company, to which the addition of a small proportion of chloretone gives increased sedative power. The stability of this latter solution is secured by the extraction of the easily decomposed albumins. A series of more than usually intractable cases by whom I had this solution used during the past summer derived from it, without exception, a most gratifying amount of relief, and the majority of them passed through the season of their previous greatest suffering with scarcely noticeable discomfort. It is to be regretted that we cannot speak as favorably of the results obtainable from the internal administration of the remedy. It certainly is not the longed-for specific that certain over-sanguine enthusiasts have asserted it to be. Given

internally it does seem in a limited number of cases to emphasize and prolong the effects produced by its local use, but it cannot duplicate these when its exhibition is restricted to the internal route. What comparatively little activity it may have when given in this way is to be obtained most completely by allowing three or four grains of the powder to dissolve upon the tongue at intervals of two or three hours.

Speaking of specifics, I may be pardoned a moment's reference to a method of treatment that its eminent author fondly hopes may prove a *great discovery*. This is an attempt at immunizing the patient by the administration of a tincture or fluid extract of the plant or flower the pollen of which seems to be particularly inimical to his pituitary membrane. Some few individuals, evidently of a highly neurotic type, seem to have been for a time more or less soothed by this novel procedure, and perchance some others may be; but it is, to say the least, a trifle premature to speak of the method as a probable great discovery and to found such radiant hopes upon it. This and many other such *bizarre* suggestions that are perpetrated from time to time appeal more to our sense of humor than to our knowledge of the physiological action of remedies.

With the subsidence of the acute attack we are confronted by the question as to what we shall do to prevent its recurrence. The solution of this problem will be found in the combination of local and general treatment. The local will consist in the (if possible) complete removal of the nasal lesion that is invariably present. There may be a very wide difference in the character of this; it may be aggressive in its prominence or so indistinct and elusive as to require careful search for its discovery, but we may be sure that a local cause for this local disturbance is never absent. Whatever this may be, it is well to postpone any active treatment of it until every trace of the acute attack has departed and the patient has had some weeks in which to enjoy his recovery and to regain his customary mental and physical

tone. There need and should be no delay, however, in studying the patient's constitutional defects and in planning methods for their correction. The putting of these into execution and carrying them to a successful conclusion is an undertaking that will demand unremitting watchfulness and perseverance from the practitioner, and the exercise of immense patience and self-control on the part of the patient. The latter must understand at the outset that it is upon his faithful co-operation that ultimate success will depend, and with this made clear to him we are ready to open our joint attack upon the host of hygienic blunders and perhaps wilful bad habits that we are to meet and overcome—self-indulgence (a term covering a multitude of sins); irregularities connected with the patient's hours for meals, for work, rest, and play; indiscretions of diet, lack of exercise, objectionable fancies in matters of clothing and bathing, and finally vicious excesses—alcoholic, narcotic, or sexual. There can be no mistaking the purpose for which this critical oversight of these matters is exercised. Everything that will lessen in any degree the patient's general vitality and vigor must be removed from his scheme of life, and everything that will contribute to his physical and more particularly his nutritive and nervous welfare should be added. After a reform has been effected in any habits of a vicious nature the accurate adaptation of the diet to any inherited or acquired morbid state is one of the next essentials. The age, the sex, the occupation, the whole environment of the patient must be separately studied and provided for in the dietary scheme. In the closest possible association with the regulation of food is that of exercise. Judiciously advised, with careful reference to the condition and needs of the patient, it is worth all the drugs in the pharmacopeia. I believe in nothing more firmly than that if a man takes care of his muscles his nerves will take care of themselves. It is then in the skilful blending of diet and exercise and their application in proper proportions to each of these patients that we have the one rational and reliable method of removing the con-

stitutional factor that is so active in the causation of hay fever. Within a reasonable time the digestive tract is restored to a state of sanitary purity, general nutrition is established upon a firm foundation, and the previously unstable nervous system, steadied and invigorated, is enabled to resist such disturbing influences as once proceeded from the contact of atmospheric irritants with the hyperæsthetic pituitary membrane; the vasomotor centres resolutely resume their domination over the nasal erectile structures, and the distressing phenomena of hay fever will be known no more. The essential idea is to put the patient upon a course of strict training that will bring out all his capacity for self-denial and self-help, that will effect a most salutary change in his whole *morale*, and will so completely remove the hyperæsthesia of the nasal sensory nerves as to make them quite indifferent to a species of irritant that once sufficed to throw them into a state of violent commotion. This plan of treatment penetrates to and combats the very beginning of pathogenesis, and, though it is often enough slow and tedious, yet to patients possessed of grit and determination it brings a sure reward.

Disturbances of the *sense of smell* are not uncommon and are classified as anosmia, hyperosmia, and parosmia.

Anosmia. This may be due to mechanical alterations of the nasal chambers which oppose the entrance of the odoriferous particles and their access to the upper or olfactory portion of the nose. Again, if the pituitary membrane is atrophic or dryer than it should be, solution of these particles cannot take place, and their odor is unperceived. Finally, disease of the olfactory nerves, either of their trunks or peripheral cells and of the olfactory centres, will result in an impairment or entire suspension of the sense of smell.

Hyperosmia. This overacuteness of olfaction is apt to occur in association with other manifestations of nervous disturbance. Anything that leads to a general lowering of nerve tone may have this symptom for one of its effects. Hysteria, neurasthenia, or

the nervous depression following some exhausting illness are at times the occasion for its appearance.

Parosmia. The same conditions that at one time occasion an abnormal keenness of the sense of smell may at another be responsible for its perversion. The imaginary odors are usually of an offensive nature, and the patient may regard them as either self-produced or coming from some external source. The affection is not, as a rule, of long duration.

The treatment of these different disturbances is based upon the cause associated with each. The nasal stenosis that may occasion anosmia is to be removed, or the mucous membrane, if dry and unresponsive to normal olfactory stimulus, is to have its secretion restored and the terminal nerve filaments aroused by local and general measures that will improve its nutrition. The treatment of hyperosmia and parosmia is that of the general conditions from which they arise.

The symptoms that are held to be of a reflex nature and as originating in some functional or physical defect within the nose are very many, but it is well to be cautious in accepting such cause for them and to exclude all others before doing so. A brief list of them will include cough, asthma, aphonia, laryngeal spasm, a variety of affections of the eye and ear, and finally a large number involving the nervous system, such as migraine, neuralgias, vertigo, chorea, and epilepsy.

If an intranasal cause sufficient to account for any of these reflex disturbances is found their treatment can be a matter of no uncertainty; but in addition to the removal of the local irritation there should always be an effort to soothe and strengthen the reflex centres that have perhaps for a long time been subjected to its enervating influence.

CHAPTER VII.

EPISTAXIS—FOREIGN BODIES—NEOPLASMS.

EPISTAXIS.

NASAL hemorrhage is of such frequent occurrence, it may be at times so alarmingly profuse, and the most efficient measures for checking it are so simple and easily carried out that no one should be unfamiliar with them. The bleeding may be occasioned by some form of traumatism, it may be due to a long-standing local lesion of varying nature, its occurrence may be the expression of disease situated elsewhere, and finally it may be constitutional or vicarious in its origin.

Any local condition which will occasion and maintain a hyperæmia of the nasal mucous membrane will predispose to epistaxis. Deflections of or projections from the septum, neoplasms, catarrhal engorgement of the turbinates, ulceration, may all at one time or another be responsible for the loss of blood. The local lesion, however, from which the hemorrhage proceeds in the largest number of cases is situated upon the septal cartilage just within the vestibular margin and not far above the floor of the nose. It is at this point that the septal artery, ascending from the superior coronary, spreads its branches over the septum. The mucous membrane here is at best very thin; it is the portion most exposed to the entering air and to the impact of whatever foreign particles it may contain, and it is consequently more apt to become dry and brittle than the better protected portions further within the cavity. The frequent removal by means of the handkerchief or finger-nail of the small crusts that are apt to form here occasions some slight epithelial loss, further thinning

of the covering of the vessel walls, and leads ultimately to their exposure and erosion.

Epistaxis is a frequent accompaniment of the general febrile diseases, of valvular insufficiency of the right side of the heart, of portal obstruction, of Bright's disease. It may result from a mechanical congestion produced through pressure upon the veins of the neck by an aneurism, bronchocele, or other tumor. This symptom may also be an incident of both plethora and anæmia, and it is one of the earliest evidences of the hemorrhagic diathesis—hæmophilia. The commonest epistaxes of vicarious nature are those following the suppression of the menstrual flow or one of a long-standing hemorrhoidal flux.

Treatment. Cocaine and the recently introduced powdered extract of the suprarenal capsule have almost revolutionized the treatment of the greater number of epistaxes. But a comparatively few years ago anterior and posterior plugging of the nasal fossæ or some form of tamponade were commonly the first things thought of in nasal hemorrhages of any severity. Among rhinologists they are now the last, and it is to be hoped that the next generation of general practitioners will have been so well instructed in the improved modern management of this accident that plugs and tampons will pass into an obscurity from which they will again emerge only upon the rarest occasions.

The greatest difficulty that used to be experienced in checking these hemorrhages arose from the inability of the average physician to locate the bleeding vessel. With our present means of illuminating the nasal chambers, however, this difficulty should no longer exist, and the man who has been drilled in the correct use of the head-mirror and the nasal speculum need have no misgivings when he is called upon to arrest a flow of blood from the nasal mucosa.

The very first step in the management of such cases, therefore, will be the adoption of measures that will enable us to discover the point from which the blood is escaping. If the hemorrhage

has been in progress for some time the nose will in all probability be more or less filled with coagula. We should not be deluded into allowing these to remain with the idea or hope that they of themselves may succeed in arresting further bleeding. On the contrary, if the nose be thoroughly washed out with water as hot as can be borne the hæmostatic effect of this will be greater than that exerted by the soft, porous clots. A wide-nozzled syringe will be the most convenient means of injecting the water, the temperature of which should be gradually raised from 100° F. to 130° F., or even higher. The cavity having been entirely freed from coagula is quickly illumined and examined through the speculum and its mucous lining gently mopped with cotton until the cluster of oozing capillaries or the spurting arteriole is clearly exposed to view. This much being accomplished, we moisten the cottoned tip of our applicator in a 6 per cent. solution of cocaine and press it firmly for a minute or two upon the hemorrhagic area. If upon its removal the bleeding is resumed, the same manoeuvre is repeated with a freshly prepared 1 to 10 solution of the adrenal extract. It will be a much larger vessel than is ordinarily found in the pituitary membrane that will resist the extraordinary constricting action of this remedy. The flow will almost invariably, for a time at least, be arrested, and during this time we are able to prevent its recurrence by touching the leaking vessel with a fused crystal of chromic acid. If the hemorrhage has been simply capillary in its origin a drachm to the ounce solution of nitrate of silver will often prove sufficient to accomplish this result. As has been said, it is the septal cartilage just within the inner margin of the vestibule that usually furnishes the source of the bleeding. If we find that there has been some more or less extensive epithelial loss here, and that the leakage from the thin-walled capillaries is due to their uncovered state, we must warn the patient against the incautious use of his finger-nail or handkerchief and adopt measures that will encourage the re-formation of the epithelium. Applications every few

days of solutions of nitrate of silver of moderate strength, 10 to 20 grains to the ounce, will do this, and we may also give the patient to use each night on retiring an ointment of the yellow oxide of mercury, 1 grain to the drachm of carbolized vaseline.

If the epistaxis proceeds from one of the varieties of neoplasm occasionally found within the nose, an angioma, fibroma, or one of malignant nature, the removal of the growth and the cauterization or curettement of its base will put an end to it.

Frequently recurring hemorrhage due to disease situated elsewhere than in the nose, though yielding upon each occasion perhaps to the local measures already detailed, can only be prevented from persistent repetition by the control of the remote cause. Cardiac valvular insufficiency, chronic interstitial nephritis, or portal congestion take precedence in therapeutic importance over the merely symptomatic local hemorrhage. Again, in those cases in which the pituitary flux is a consequence of the mechanical vascular distention maintained by an aneurism or bronchocele, we can hope for little more than palliation so long as such obstacles to normal venous drainage continue operative.

As specialists, the greatest demand upon our resources is made by those who are the subjects of hæmophilia, popularly known as "bleeders," or in those in whom serious epistaxis occurs as a symptom of acute leukæmia, purpura, or scorbutus. These cases are apt to prove exceedingly rebellious to ordinary astringents however well these may answer in those hemorrhages due to a local lesion. Cocaine is worse than useless, because of its secondary relaxing effect upon vascular tone, in consequence of which a few minutes' suspension of the flow may be followed by its return in increased quantity. No such objection can be lodged, however, against the suprarenal extract, and this substance has the advantage of being powerfully active, both by topical application and by internal administration. Its systemic action is that of a muscle tonic, it increases the contractile power of all muscle fibres and appears to possess a selective action upon those of the heart

and arteries. Its power to restore normal blood-pressure is of particular value in the diseases now under consideration, all of which are marked by lowered arterial tension and a tendency to passive superficial or submucous hemorrhage. Locally, after the preliminary cleansing of the nose with hot water, the most efficient method of using the adrenal will be by the injection of a 1 to 10 freshly made and filtered solution. Simultaneously five grains of the powdered gland are to be placed upon the tongue and gradually swallowed as it mingles with the saliva. During the continuance of the hemorrhage this dose may be repeated every two hours until palpitation or other constitutional effects of the drug become manifest. In cases of any urgency the 10 per cent. solution may be used hypodermically, the one essential precaution being that it shall be perfectly aseptic.

It will probably be only in exceptional instances that the measures thus far reviewed will fail to arrest the flow of blood. For the few exceptions, however, we are compelled to fall back upon some form of mechanical pressure. It will be futile and perhaps somewhat hazardous if in the face of failure up to this point we consume any more time in experimenting with such articles as peroxide of hydrogen, antipyrine, ferripyrine, or insufflations of alum or tannic acid. If far more powerful hæmostatics have proved inefficient these will be scarcely likely to succeed. We have arrived then at the point where the only thing that remains to us is the tampon. The material employed for packing the nose should be one of the varieties of antiseptic gauze. If the bleeding-point be within easy view and reach from the anterior nares we need not pack the whole cavity but merely blanket the point itself. The gauze is cut in strips of sufficient length to reach some little distance beyond the leaking vessel. A large-sized speculum is selected, and through this the portions of gauze are introduced with the angular forceps and pressed down upon one another from the floor of the nose upward until they have risen somewhat above the source of hemorrhage.

In many of these cases the Bernay sponge, a disk of compressed absorbent cotton, will be found equally efficient and much more easily and quickly introduced than the gauze. If the bleeding area is extensive, or perhaps if it involves the whole cavity, the posterior nares should also be tamponed. For this purpose the Bellocq canula is now but seldom used, its place having been taken by a soft rubber catheter or a flexible bulbous bougie. This little instrument is passed along the floor of the nose into the nasopharynx, and when its tip appears below the edge of the velum it is seized with forceps and drawn out of the mouth. To it is attached a piece of ligature silk about sixteen inches in length, having secured at its centre a pledget of gauze of a size to fill the choana. The bougie being now drawn out of the nose brings with it the cord of silk, and with this the gauze is partly pulled, and with the finger of the other hand partly pushed upward back of the velum into proper position. The two ends of the silk ligature—the one from the nose, the other from the mouth—are loosely tied, hung over the ear, and retained by a strip of adhesive plaster. The operation is now completed by filling the anterior portion of the cavity with gauze. This dressing may be safely permitted to remain for thirty-six hours or a trifle longer. The anterior portion is removed very gently, one strip at a time, the posterior plug drawn down and out through the mouth by the cord attached to it, and the cavity then cleansed so gently that hemorrhage will not be re-excited. If necessary the chamber may be repacked after thorough cleansing and antiseptics, but the necessity will occur but seldom.

However skilfully this method of tamponing just described may be carried out, it is exceedingly disagreeable to the patient, and the gagging almost invariably occasioned by it may render it anything but easy for the physician. An instrument of very recent introduction will probably supplant this whole procedure and make the packing of the nose a perfectly simple matter for the physician, while it will minimize the unpleasantness of the

operation to the patient. This is called the "Darmack Surgical Dressing Packer" (Figs. 34 and 35). I have used it as yet but a few times, but on each of these occasions it performed its work so rapidly and satisfactorily that hereafter I shall undertake the

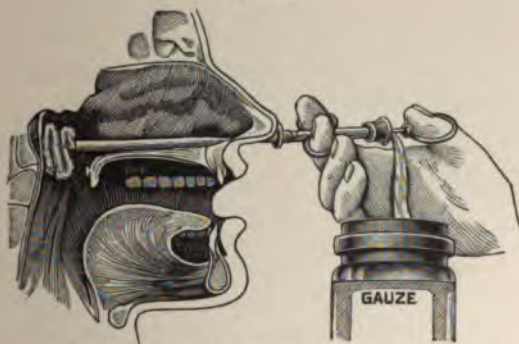
FIG. 34.



Darmack surgical dressing packer.

operation with much less reluctance than formerly. For nasal purposes it is made in two sizes, the smaller, 5-32 inches in diameter, entering a child's nose without difficulty. The outer tube of

FIG. 35.



Method of tamponing nasopharynx and nose.

the instrument has a piston or push-rod within it, and it is with this that the strip of gauze is propelled into the cavity to be filled. The amount of pressure to be exerted by the packing is readily varied, and not the least of the instrument's attractive

features is the ease and quickness with which the dressing can be subsequently removed.

FOREIGN BODIES.

Articles of widely varying character are frequently pushed into the nasal chambers by children out of curiosity, are secreted there by subjects of dementia or other mental disturbance, and may obtain accidental access to them *via* the nasopharynx during the acts of coughing or attempted expulsion of them from the lower air or food passages.

The promptness and severity of the symptoms that they occasion depend upon their composition, their size, and the smoothness or irregularity of their surface. Those that are both small and unirritating may provoke such very slight disturbance that their presence may be unrecognized for long periods. When they are of greater size, however, or have rough, sharp outlines the resultant symptoms are early in their appearance. It is but seldom that both cavities are simultaneously involved in this way, and, therefore, these symptoms are usually unilateral. Obstruction, discharge which keeps pace in abundance and character with the degree of inflammation, pain, slight hemorrhage, perhaps, and external swelling, all announce the presence of some irritant. Inspection will usually reveal it unless it is well within the fossa and hidden by a quantity of secretion and the swelling of the mucous membrane in front of it. Some history is generally obtainable, however, which will clear up any diagnostic doubt. If the body has been present for some time and has injured the tissues to any extent, or if unskilled attempts to remove it have been made, we may find, in addition to mere swelling, more or less erosion of the mucous membrane, ulceration, and possibly in rare cases extensive destruction.

Treatment. If one has a good light and suitable instruments the extraction of a foreign body from the nasal passages of the

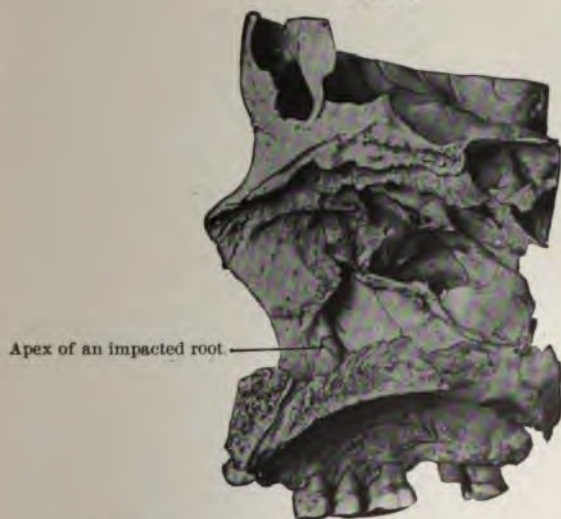
PLATE III.

FIG. 1.



An impacted canine tooth with the apex of the root within the nasal fossa. (Cryer.)

FIG. 2.



External wall of the nasal chamber, seen from the inside, showing the apex of the impacted canine tooth. (Cryer.)

adult is quite a simple matter, but when the patient is an alarmed and refractory child, the body well within the fossa and too smooth to afford a firm hold to instruments, and there is present also any degree of swelling of the mucous membrane, the difficulties of extraction can scarcely be exaggerated. Vast quantities of patience, tact, gentleness, and skill are usually necessary to success, and if the physician be lacking in any of these qualities the best substitute for them is the administration of a general anæsthetic. If, however, the child be fairly quiet and the body not deeply inserted it may generally be removed without the aid of ether or chloroform. The patient is best held upon the lap of the parent, the secretion obscuring the body gently removed by pledges of dry cotton upon the carrier, and then the mucous membrane in front of it anæsthetized and contracted by a 2 per cent. cocaine solution in spray or upon the cotton-applicator. If there

FIG. 36.



Buck's ear curette.

is any great degree of swelling of the tissues the adrenal solution may also be of use. When the pathway for the exit of the body has thus been cleared it may be moved a little forward at times by inducing the child to blow the nose, and it may often be expelled altogether by introducing the tip of the Politzer bag into the opposite nostril and compressing the bag with moderate force. Failing in this the physician has a variety of instruments at his service. The choice, however, depends so much upon the size, shape, and situation of the foreign body that the operator must be left to his own judgment. The instruments that I have found of most frequent service have been Buck's blunt ring ear curette, a delicate hook with a slender shaft, and an angular forceps with roughened or rat-tooth extremity. If the child be restless sufficient assistance must be obtained to have it firmly held, since any struggling will be apt to defeat the most skilful manipulation of

instruments. If such aid is not to be had the necessary quietness may be secured by means of a little chloroform.

At very long intervals there are reported cases in which insects have made their way into the nose, or the larvæ of flies having been deposited within the vestibule or anterior nares are hatched by the heat and moisture and the nose becomes the abode of a number of maggots. In the warmer climates such cases are not infrequent, but they are of such rare occurrence in northern countries that very few specialists ever see them. The accompanying symptoms are similar to but more severe than those produced by inanimate foreign bodies. The most effective method of removal is the injection of chloroform. The cavities are first cleansed as well as possible, then anæsthetized with cocaine in 4 per cent. solution, and finally chloroform, diluted with an equal quantity of water, injected. After the larvæ and matured maggots have been destroyed in this way they should be expelled from the nose by vigorous syringing.

Rhinoliths, stray teeth, and other curiosities in the way of foreign bodies are also found now and then in the nasal fossæ. The symptoms provoked by them and the methods employed for their removal do not differ essentially from those already described.

NEOPLASMS.

Although several varieties of new-growths are encountered within the nasal chambers there is but one that is of frequent occurrence. This is the myxoma or mucous polyp.

Etiology. There is no general agreement as to the causation or mode of origin of this tumor. A polypoid diathesis, ethmoid necrosis, disease of the accessory sinuses, and other theories more or less plausible have been separately suggested as explaining it; but while at times no doubt each of them has been etiologically active there is none of them that is invariably present. We may be pretty well assured, however, that preceding the appearance of

the polyps there is a persistent irritative hyperæmia of the mucous membrane that largely contributes to their birth and subsequent growth. Perhaps as the result of a series of neglected coryzas the mucous membrane, particularly that covering the middle turbinate, becomes swollen and somewhat cedematous, it undergoes a mucoid or myxomatous degeneration, and then at certain points, depending probably upon some peculiarity of vascular arrangement or tissue structure, appear the circumscribed prominences or buds which denote the future polyp. They are almost always multiple and pedunculated, and their nasal site, as has already been intimated, is some portion of the surface of the middle turbinated body. Their most frequent point of attachment is to the lower border of this body or upon its outer surface, within the recess between it and the external wall of the nose. The size of the mucous polyp is governed by its age and the spaciousness of the cavity in which it grows. The one situated anteriorly is usually that of greatest size, often filling the vestibule and even at times projecting from it. Both nasal fossæ participate, as a rule, in this disease, although it is not a rare occurrence to find a single polyp in one or the other cavity. The growths are somewhat more frequent in the male than in the female, and they may be found in the youngest children as well as in individuals of advanced age.

Pathology. The structure of the myxoma is of very simple nature, a mass of loosely woven connective tissue, with a covering of ciliated epithelium, and containing a gelatinous, almost fluid, substance made up largely of mucin. The bloodvessels are moderately abundant, but are almost entirely limited to the surface, while the nerve-supply is conspicuous by its meagreness and at times apparent absence.

Symptoms. The number, size, and location of the tumors determine to a great extent the symptoms provoked by them. When they are numerous and of sufficient size to fill the lumen of the nasal chambers mouth-breathing is of course inevitable, and is

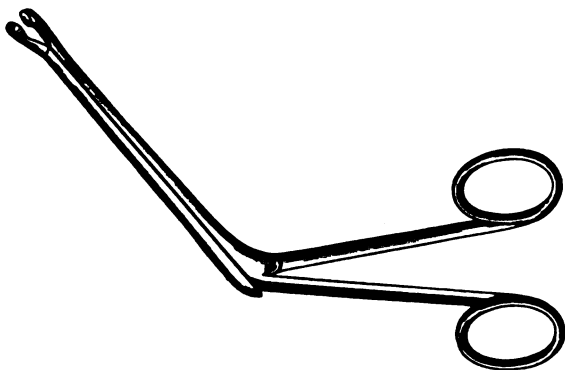
accompanied by the usual dry, irritable throat and husky voice. The voice also loses entirely its characteristic quality, and becomes absolutely flat and non-resonant. The discharge is usually excessive, seromucous in character, and may be, if it is slow in escaping, or if there is associated sinus or ethmoid disease, offensive. The sense of smell, always seriously impaired, may be entirely suspended. All the symptoms are usually much aggravated during damp weather as a result of the hygroscopic properties of these tumors. It is not surprising that many of the nasal reflexes occur in association with this disease—cough, asthma, neuralgia, or dizziness.

Diagnosis. To the practised eye the mere appearance of the growth is usually sufficient for diagnosis. Instead of attributing various shades of color to it, probably the most satisfactory description of its appearance is the statement that it resembles very closely the pulp of a grape. The color is about the same; it is translucent or semitransparent, it pits on pressure with the probe, and its surface presents an arborescent arrangement of the vessels. It is more or less movable in proportion to the length and slenderness of the pedicle. The use of the probe will enable us to trace the growth upward from its extremity to its attachment, and thus to exclude neoplasms which arise from the septum or inferior turbinate. At times some peculiarity of conformation of the middle turbinate may puzzle the young rhinologist. Occasionally this body projects almost straight inward from its attachment to the outer wall, and then turns abruptly downward. If at the same time its anterior extremity happens to be rather bulbous and cedematous or mucoid it may very closely resemble a neoplasm depending from some point in the upper portion of the cavity. The ability of the probe, however, to determine its comparative density and immobility and to make its point of origin clear to us should make an error in diagnosis impossible.

Prognosis. The liability to the return of these tumors when once removed depends upon the thoroughness of their removal

and upon the presence or absence of any complicating disease, such as a chronic sinusitis or necrosis of the ethmoid. In uncomplicated cases the prognosis is quite satisfactory, provided the patient is willing to submit to the necessary duration of treatment.

FIG. 37.



Alligator forceps.

Treatment. Certain obsolete methods need but passing reference as a warning against their future employment. Astringent injections into the substance of the growth, insufflations of powders, such as tannin or alum, and the superficial application

FIG. 38.



Nasal scissors.

of chemical caustics, are all as ineffectual as they are tedious and painful, and have long since been abandoned.

Completeness and permanency of cure are only to be secured through mechanical avulsion, and this may be effected by the snare, forceps, or scissors. The latter two instruments are chiefly

of use when the growths are small and their bases easily accessible. In such cases the alligator forceps with cutting edge (Fig. 37) or the scissors illustrated in Fig. 38 prove very satisfactory. For larger growths, however, those which almost fill the nasal chamber and whose pedicles are quite hidden from view, the cold wire snare is by far the best instrument at our service. Pain and hemorrhage are both minimized by it, and the operation is rendered much less formidable by its skilful manipulation. There is much room for the exercise of one's own fancy in the choice of a snare, but I think there can be little doubt that for the beginner the Jarvis is the most satisfactory and presents the fewest difficulties in its use. It should be threaded with the No. 5 piano wire, and this if it be silver-plated may be purchased in quantity and kept indefinitely without rusting. Previous to the

FIG. 89.



introduction of the snare the nose should be cleansed as well as possible, and since the patient is generally unable to blow the nose it must be mopped dry with cotton. This accomplished the tissues are to be cocaineized. The 4 per cent. solution is of sufficient strength and is introduced upon the applicator, which is passed upward upon each side of the growth from its lower extremity to its pedicle. The mucous membrane of the floor, the septum, and the lower turbinate are thus anæsthetized, and the wire loop may now enter the cavity without inflicting pain and, what is perhaps equally desirable, without provoking sneezing. This latter reflex, when frequent, may seriously interfere with our success in engaging and retaining the polyps within the loop, as well as by refilling the nose with a flood of secretion and obscuring our view. The illumination of the cavity should be as brilliant as possible, and, to secure this, as large an operating

speculum as the vestibule will admit should be employed. In entering the nose the plane of the loop should be vertical, and when its tip has been passed along one or the other side of the tumor a sufficient distance beyond it, the lower end of the wire is carried beneath it to the opposite side, and the loop then worked upward toward the pedicle. As it rises in this way it should be gradually drawn within the snare, the tip of which is kept well elevated and in close contact with the growth, so that it may not escape. When the pedicle is finally reached the nut is screwed down upon the sliding canula and the tissue slowly severed. The more slowly this is done the less will be the hemorrhage, which may be limited, perhaps, to a very few drops of blood. This being brushed away the cocaineization is repeated if necessary and the next polyp approached. After each sitting, and generally several are required to entirely clear the nose, the fossæ are sprayed with the Dobell and a warm solution of hamamelis and then dusted with the zinc stearate combined with boric acid or menthol. The satisfactory removal of these neoplasms demands much patience and considerable skill, and when it is finally accomplished we should not neglect measures which will prevent their recurrence. This necessitates the destruction of the morbid tissue from which the polyps have sprung. Even after the complete removal of the growths themselves we have remaining a mass of degenerated tissue covering the middle turbinate, which favors the indefinite reproduction of them. For the obliteration of this we may employ the curette, the cutting forceps, an appropriate form of scissors, or the snare itself; and when these have been effectually used we may complete the treatment a few days later by the application to any points needing it of the galvanocautery or chromic acid. This thoroughness of treatment requires time and patience, but we shall be repaid by the permanency of cure which it ensures.

It will not be wise, however, for us to regard our work as finished as soon as we have reached the end of our surgical re-

sources. Although we may have removed all actually pathological tissue, yet we will invariably find that we still have to deal with a high degree of catarrh of the remaining mucous membrane. If we ignore this and permit the patient to discontinue treatment immediately upon the removal of his polyps and the degenerate tissue from which they have sprung, it is more than probable that the neglected catarrhal process will sooner or later reproduce the whole trouble. To save ourselves awkward explanations, therefore, when the patient returns a year or so later in the same condition as when we first saw him, we had better insist that he shall continue his visits until we have succeeded in relieving him of the catarrhal process itself.

Two other types of benign neoplasm occur sufficiently often in the nose to deserve mention—the one, *papilloma*, involving the epithelial tissue, the other, *angioma*, which affects the connective tissue. The first of these is usually found upon the lower turbinate or the anterior portion of the septum, and this situation, as well as its warty appearance, should easily prevent mistaking it for a mucous polyp. The snare or forceps followed by the curette best secures its removal and non-recurrence.

The angioma usually selects for its site the mucous membrane covering the septal cartilage. It is not, as a rule, of any great size, and occasions but little obstruction. It may be sufficiently vascular and the vessels be of such dimensions that we may detect distinct pulsation. Its tendency to frequent bleeding is its most prominent symptom, and the amount of blood lost may be large enough to exercise an effect upon the patient's general condition. The methods of removal are similar to those employed for the papilloma. Occasionally the growth is sessile, and there is some difficulty in retaining it within the loop of the snare. This may be overcome by first transfixing its base with a needle and then applying the snare beneath this. The loop should cut its way through very slowly in order that hemorrhage may be discouraged, and when its detachment has been accomplished the

base of the growth should be well seared with the galvanocautery or thoroughly cauterized with chromic acid.

Of the malignant growths probably the one most frequently encountered—yet it is very rare—is the small round-celled sarcoma. This is of rapid development, soft, and very vascular, and after completely filling the nasal chamber in which it grows may invade neighboring cavities. It usually originates in the upper portion of the nasal fossa, and within a few weeks is crowding the septum to the opposite side and occasioning marked external swelling of the face. Severe hemorrhage from this form of growth is apt to be of frequent occurrence, and as a consequence the patient's appearance may become quite cachectic.

The diagnosis should be made by the removal of a small portion of the growth and the microscopical examination of this fragment.

In the treatment anything less than complete extirpation of the tumor will almost always be followed by its very rapid recurrence, and upon the extensiveness and accessibility of its site of origin will depend very largely the possibility of its removal *per vias naturales*. If this be impracticable resort must be had to one of the more or less formidable operations that have been devised for the extensive opening of the nasal and nasopharyngeal cavities. Selection may be made from among those of Rouge, Langenbeck, Ollier, Brun, or Boeckel, any of which will enable us not only to remove the tumor itself but to thoroughly eradicate the diseased soil from which it has sprung.

CHAPTER VIII.

AFFECTIONS OF THE SEPTUM.

HÆMATOMA AND ABSCESS.

HÆMATOMA is almost invariably of an acute nature, being consecutive to some form of traumatism. It is usually limited to the cartilaginous portion of the septum, and may present on both sides or upon only one. The symptoms attending an ordinary accident fail to subside with their customary rapidity, and the patient is annoyed by a persistent obstructive swelling just within the anterior nares. Moderate pain or tenderness may be associated with it and some increase of serous secretion from the neighboring mucous membrane. Simply lifting the tip of the nose is sufficient to reveal the tumor projecting from the septum and perhaps completely filling the nasal entrance. It is commonly of a bright cherry red in color, and easily yields to the pressure of the probe. The most ordinary care in its examination, with the assistance of the history of recent accident, should prevent any mistake in diagnosis. It can scarcely be mistaken for a mucous polyp because of its color, its immobility, and the entire absence of anything like serous œdema or translucency. The probe, if not the eye, will show that it is not pedunculated and that its broad base rests upon the septum. Nevertheless, it has occurred more than once that attempts have been made to snare these acute traumatic tumors.

Treatment. Prompt evacuation of the effused blood is the rational procedure. The tumor is incised at its lower border, and after the escape of its contents is thoroughly washed out by syringing with an antiseptic solution. A 1 to 1000 or 500 solu-

tion of formalin will be suitable. Moderate pressure is now applied by a pledget of gauze, which should be removed in twenty-four hours for purpose of examination, and then, if necessary, re-applied. If the hæmatoma has been neglected, or if the blood has been allowed to remain, in the hope that it would be absorbed, we are apt to have within a few days its transformation into an abscess. If spontaneous opening of this be waited for necrosis of the septal cartilage is almost a certainty, its extensive destruction probable, and, upon cicatrization, a resulting serious deformity of the nose possible. With the development of the abscess the color of the tumor changes, and fluctuation is obtained by the probe or the finger-tip. The treatment is a repetition of that for hæmatoma, but after the abscess cavity has been thoroughly emptied and cleansed a small tent of gauze may be introduced through the incision to prevent its closure and to provide for drainage. Pressure should be made over this, the cleansing repeated, and the dressing changed once or perhaps twice in the twenty-four hours.

It may be added that the perichondritis occasionally following typhoid or typhus fever, erysipelas, and other systemic infections may attack the septal cartilage and eventuate in abscess formation.

EROSION—ULCERATION—PERFORATION.

These are successive steps in a not uncommon process affecting the cartilaginous septum. Irritants of either external or internal origin may occasion persistent congestion and dryness of the mucous membrane in this region, and the annoying itching or tickling which attends it leads to additional irritation through the attempt to relieve it by frequent resort to the handkerchief or finger-nail. A list of the commoner causes would include the formation of crusts at this spot in dry or atrophic rhinitis, daily exposure through occupation to acid fumes or mineral dusts, syphilis or tuberculosis, and diathetic or cachectic states, such as

lithæmia, struma, or rickets. From the slight epithelial loss of the early stage to the final necrosis and perforation of the cartilage is usually a very long interval, and the cause being removed, if possible, the local treatment will vary more or less with the time at which we see the patient. The affected area should be thoroughly cleansed by rubbing it with the alkaline solution and hydrogen dioxide. If any little oozing of blood should be caused by this friction it may be checked by a weak cocaine solution, the surface dried, and then lightly mopped with a 10 or 20-grain solution of silver nitrate, a 10-grain solution of zinc chloride, or some similar stimulating astringent. Whatever the agent selected, it should at first be used in weak and later, if necessary, in stronger solution. The application of this may be immediately followed by that of an ointment, and there is none better than the grain to the drachm strength of the yellow oxide of mercury. This is to be given to the patient and applied by him nightly upon retiring.

If perforation has occurred we cannot hope to close it, but by restoring the integrity of the mucous membrane surrounding it, and checking further crust formation and bleeding, we may prevent any enlargement of it. The perforation of itself is seldom the occasion of any degree of annoyance or discomfort.

DEFORMITIES.

The normal vertical and straight from end-to-end septum is very rarely seen, and the infrequency of it is the more marked in those countries where football, fist-fighting, and other such rough sports are national pastimes. The departures from the normal plane are of such infinite variety and they so commonly merge into one another that it is scarcely worth while to attempt any formal classification of them. The etiology includes not only traumatism, the frequency of which has already been hinted at, but also departures from the normal plan of development. A

V-shaped upper maxilla, for instance, with a correspondingly highly arched hard palate, will compel the growing septum to complete its development by bending to one or the other side of the middle line. A gradually applied force such as this usually results in a more or less graceful and gentle vertical curve of the septum, but the distortions due to traumatism have no such character. The large majority of these latter are limited to the cartilage forming the anterior third of the septum, and if this be not actually dislocated by having its lower border thrown from its bed in the spinous process it is liable to be bent in any direc-

FIG. 40.



Fracture and deflection of bony septum, followed by deposit of redundant tissue and formation of a prominent ridge. (CRYER).

tion and to any degree. The deflections involving the bony septum are, as a rule, found in the adult, the accidents to which one is exposed at this time of life being usually more severe than those of childhood. The anterior cartilage, too, has become more resistant, and is apt to break rather than bend to any applied force. Added to the mere deflection we almost always find more or less thickening of the septum at its most prominent portion, this being the result of the perichondritis or periostitis following the accident and the deposit of additional cartilage or bone for the support of the weakened structure. (Fig. 40.)

Where this redundant tissue is present in such quantity that it would be of itself obstructive after the straightening of the septum it should be removed preliminary to or coincidently with this operation. If the deflection is of any degree we will have corresponding to the convexity on one side a concavity on the other, and this should give to the latter side of the nose an increased capacity. As a matter of fact, it is not unusual for us to find projecting into this concavity a greatly enlarged inferior turbinate. This seems, in consequence of the crippling of the turbinate of the other side, to have undergone a compensatory hypertrophy, and preceding any attempt to straighten the septum this must be reduced.

ECCHONDROSES—EXOSTOSES.

In association with its deflections or perhaps quite independently of them we often meet with cartilaginous or bony projections from the surface of the septum which, according to the predominating type of tissue present in them, are known as ecchondroses or exostoses. These assume various shapes and degrees of prominence, and in consequence receive different names, the spur and ridge being those most often encountered. Operation for their removal will be trifling or formidable in proportion to their extent and their situation.

Treatment. Before resorting to surgical procedures for the correction of any septal deformity it will be found an excellent rule to spend a week or two in subduing to some extent the chronic catarrhal rhinitis that is almost invariably present; and, indeed, it will not infrequently be discovered that when we have effected a reduction of this the operation that seemed at first glance a necessity may be dispensed with. It will be pertinent to suggest just here that an operation should never be contemplated unless the symptoms occasioned by the deformity are of sufficient urgency not merely to excuse but to demand its

removal. Cosmetic or artistic sentiment should not be allowed to affect one's judgment in a matter of this kind. If there is no external deformity, if there is no such embarrassment of nasal respiration as to compel mouth-breathing, and not enough pressure upon the turbinates to provoke any of the nerve reflexes, a wide departure of the septum from strictly normal lines may be permitted to remain unmolested. The past decade has witnessed a great excess of nasal surgery. The exercise in the next of a little common-sense will do much to restrict it.

For the removal of the *ecchondrosis* from the septal cartilage or the *exostosis* from the bony portion of the septum we have at our disposal a wide variety of knives, scissors, and saws. Gouges and drills are also used at times, as well as a number of other instruments of greater or less ingenuity. From among these I have selected for illustration those that I have found most serviceable and which will prove quite capable of coping with any form of septal outgrowth. Whether we shall use cocaine or general *anæsthesia* in these cases depends upon the extent and probable duration of the operation and the nerve of the patient. Quickness in operating comes with experience, and as this is acquired the employment of general *anæsthesia* will become less and less frequent. The operative preliminaries consist simply of the thorough cleansing of the nose and nasopharynx, the cocaine-ization of the area that is to be attacked, and five minutes later the application to it of a solution of the powdered adrenal extract. The cocaine should not be used in greater strength than 6 or at the most 8 per cent. The *anæsthesia* obtained by this solution is complete and quite sufficiently prolonged for the even leisurely performance of any ordinary operation. It is to be applied of course by means of the cotton-carrier, and not by the dangerous methods of the spray or the introduction and retention for several minutes of pledgets of absorbent cotton saturated with the solution. Immediately upon the thorough *anæsthetization* of the mucous membrane the final preparatory step for the opera-

tion will be the use of the suprarenal extract. Of this we may prepare our own solution by adding 6 grains of the powder to the drachm of a 1 per cent. solution of resorcin, shaking it well and then filtering, or instead of this extemporaneous solution we may employ an admirable preparation recently marketed by Parke, Davis & Co., called suprarenal liquid with chloretone. This combines in the happiest manner the vasoconstricting effects of the gland with the anæsthetic and antiseptic qualities of the chloretone. In scarcely more than a minute the mucous membrane will have turned a dead white, and the anæsthetic effect of the cocaine will have been intensified by that of the chloretone. The difficulties formerly inseparable from operations within the nose have been wonderfully reduced by these two solutions. Pain is almost if not entirely eliminated, interruptions from paroxysms of sneezing in the midst of the operation no longer occur, and hemorrhage, which until within a few months was our greatest obstacle to rapid and accurate operation, is now conspicuous by its absence. No longer is our field of operation obscured from the first stroke of the saw or knife by streams of blood and quickly formed clots; no longer are we compelled to frequently suspend our work while we mop these out and try to catch a hurried glimpse of what we have accomplished; and, finally, no longer must we lower our hands every few moments while the patient turns to clear his throat of the blood that threatens to choke him. No, we bid farewell to all this as we enter upon a new century, and thanks to cocaine and the suprarenal gland we may look forward to an ease and accuracy in nasal surgery that but yesterday were undreamt of.

The preliminaries to the operation having been completed, a half-dozen applicators are charged with cotton, the instruments—sterilized—are arranged upon the table in the probable order of their use, and having in view a possible sudden loss of nerve upon the part of the patient it is just as well to have within easy reaching distance a little whiskey or aromatic spirit of ammonia.

If it is a spur or ridge that is to be removed, or any redundancy of tissue associated with a deflection, the younger operator will be almost certain to take off too little rather than too much. As the timidity of inexperience wears off, however, the route originally planned for the knife or saw will be adhered to throughout the operation, instead of being departed from the moment a little blood makes its appearance or the patient exhibits any signs of pain or nervousness. It is but very seldom that there will be any occasion to preserve all the mucous membrane by denuding the deformity of it previous to the removal of the latter. While this may seem quite desirable from a theoretical point of view, as a matter of practical importance it amounts to very little. The time required for entirely uncovering the bone or cartilage will

FIG. 41.



Cartilage knife, curved upon the flat, for removing ecchondroses of the septum.

FIG. 42.



Rice nasal saw.

add very materially to the duration of the operation, and the fact that any lost mucous membrane will be reproduced during the process of healing makes so much care and consumption of time quite unnecessary. A large variety of more or less ingenious instruments for the removal of exostoses or ecchondroses may be found in the shops, but those here illustrated will be found, I think, entirely sufficient for all ordinary cases. When the obstructive growth has been cut or sawed through, severed from any remaining attachments by the scissors, and then removed by forceps, the cavity is mopped free from any little blood that may have escaped, and some pledgets of iodoform or other antiseptic gauze then introduced to check and prevent further bleeding. For these strips of gauze a "Bernay sponge" of appropriate size

will often be found a very convenient and satisfactory substitute. Whatever may be the primary dressing used, it is to be removed at the end of twenty-four or thirty-six hours, since its longer retention will invite the occurrence of sepsis. Both nasal chambers are now thoroughly flushed with the cleansing and mildly antiseptic Dobell solution, and the wound rendered still cleaner by an application with the cotton-carrier of some peroxide of hydrogen. It will be wise, at the same time, to carefully examine and spray the faucial region, for in spite of all antiseptic precautions it will not be infrequent that the moderate congestion of this space ensuing upon the operation will render it vulnerable to the attacks of the pathogenic organisms from which it is seldom entirely free. It is owing to this that an infective tonsillitis is a by no means uncommon sequel to intranasal operations. The wound is now lightly dusted with some stearate of zinc combined with aristol or nosophen, and the patient is cautioned to blow the nose rather gently when freeing it from secretion. It will very rarely be necessary to reintroduce anything in the nature of a tampon. The danger of secondary hemorrhage is almost *nil*, and with daily cleansing and dressing, and in the absence of accidents, cicatrization should be well advanced or quite complete at the end of ten days or two weeks.

DEFLECTIONS.

Any operation upon a septal deflection which has for its purpose the obliteration of this deformity should provide also for its non-recurrence. The cartilage of the septum is always more or less involved in these deformities, and when it has for any length of time occupied an abnormal position the mere incision of it at its most prominent point and its replacement in the middle line will not suffice to keep it there. It is possessed of an extraordinary resiliency that is not to be overcome by simple incision and pressure, however prolonged and extreme the latter

PLATE IV.

FIG. 1.



FIG. 2.



Anterior and posterior views of an example of septal deflection producing practical obliteration of right fossa.

may be. After an incomplete operation such as this the removal of the splint or gauze packing or whatever form of support may have been used is quickly succeeded by a reappearance of the deformity that we have attempted to correct. The one principle by the thorough application of which success may be attained is the complete destruction of this resiliency, so that even if no retaining apparatus be introduced the cartilage will be powerless to resume its faulty position. This is a principle that had been recognized and more or less successfully applied in practice for many years by a limited number of operators, but it was not until 1890 that general notice was attracted to it and its much wider adoption secured through the energy of Asch in demonstrating that its thorough application was indispensable to operative success. The infinite variety of deformity encountered may require an infinite variety of detail in the operations performed, but the predominant principle in each should be the one just stated. I do not propose, therefore, to describe and discuss a number of trifling operative tricks, the fancied first employment of which has now and then led some of us into the harmless little weakness of talking and writing about "*my* operation." The study of a few of the more common types of deformity will be sufficient to demonstrate the need for much surgical ingenuity, and if the one important principle be remembered the rest can be safely left to each man's native cleverness. The abundance of such cleverness is evidenced by the very great number of instruments that have been devised to facilitate these operations. They vary in their purposes—scissors, cutting forceps, and knives being employed for penetrating the bony and cartilaginous structures, other forceps being used to thoroughly break up the refractory tissues and divest them of their misdirected energy; and finally a variety of solid or tubular splints for the purpose of subsequent support until firm union of the fragments shall have taken place. For the satisfactory performance of the very large majority of these operations I find that two instruments and my finger are all

that are really essential. The instruments are the Douglas perforator and his probe-pointed curved knife. The perforation is made from the concave side of the septum at the posterior margin of the deflection, and at a height above the nasal floor that will about correspond to the most prominent point of the convexity. The curved knife being introduced into the opening thus made cuts its way forward to the anterior limits of the deflection. A large Allen speculum permits a perfect illumination and view of the field of operation, and there need be no difficulty whatever in making this incision not only rapidly but much more accurately than can be done with scissors or cutting forceps. A second incision, usually at a right angle to the first horizontal one, is now made, crossing it as nearly as possible at the apex of

FIG. 43.



Douglas septum perforator.

FIG. 44.



Douglas curved septum knife.

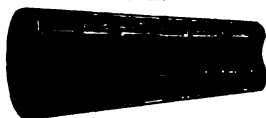
its curve. These incisions are the ones that will usually best secure the reduction of septal deflections, but the mechanical ingenuity of the operator may suggest innumerable variations that will add to the ease and excellence of the operation. These often desirable variations are much more readily effected, I think, when the instruments we employ are simply the perforator and the knife. While the Asch operation and the Asch instruments are undoubtedly of great service in a class of selected cases, it is this very necessity for selection that imposes limitations upon his methods. Certain extremes of deformity are not infrequent in which the introduction of his rather formidable scissors within the nasal fossæ is manifestly impossible. In such cases some preliminary operation would have to be performed in order to render

their subsequent employment practicable, and when we have in the Douglas perforator and knife a pair of instruments that are able to deal with even the most grotesque of distortions, I cannot help thinking it wiser to perfect one's self in their use rather than to become more or less dependent upon a set of implements that are not of universal applicability. It will be impossible to take up each of the commoner types of deformity and to discuss its treatment separately. So far from doing this, indeed, it will be much better to develop and to give as great exercise as possible to one's own originality in the conception and execution of these operations. When the septum then has been freely divided it remains only to restore it to its normal position, and in doing this to so completely rupture its misdirected fibres that they will become impotent to again leave their proper plane. As a result of our two incisions we have meeting at a common point the apices of four triangular flaps. The tip of the index finger inserted within the obstructed fossa is made to cover this, and the deflection then pushed *en masse* into the opposite fossa, the force applied being continued and increased until each distinct flap is felt to break at its base, and thereupon to lose its power to resume its malposition. When this has been accomplished and each has been robbed of its resistance the operation is complete. We have but to free the nose from any effused blood, to introduce upon the previously occluded side a tubular splint of suitable size and shape, and upon the other a small portion of gauze that will restrain the usually trifling hemorrhage. The splint selected should be no larger than is just sufficient to keep the limp and unresisting septum in the middle line. Its purpose is simply to afford support to the fragments, and should it be of such size as to exert any pressure upon them it will interfere with their nutrition, and, therefore, with the rapidity and firmness of their union. The numerous fenestra of the Asch and Mayer tubes, so far from increasing their usefulness, are, I think, objectionable. They are of no value worth mentioning for purposes of drainage, and they



add to the irritating qualities of the splint by lessening the smoothness of its surface and by permitting the exuberant granulations which they provoke to project into the lumen of the tube, and so to interfere with its removal. The Douglas splint (Fig. 45) has not these objections. At the end of twenty-four hours the gauze may be withdrawn and that side of the nose, together with the nasopharynx, thoroughly cleansed. The splint need not be disturbed until the following day, and then, as soon as the cleansing and antiseptics of the cavities have been attended to it is to be reintroduced. The length of time that it should be worn depends very largely upon the extensiveness of the operation; but three weeks is little enough, as a rule, and the period may often be prolonged with advantage. After the first week, if the patient

FIG. 45.



Douglas tubular nasal splint.

be shown how to remove, clean, and replace the tube, the nose need be re-examined only every few days to see that cicatrization is progressing favorably.

Probably the most frequent cause of failure in our early operations is timidity. The fear of inflicting additional injury stays our hand when it is in the very act of giving relief. This sense of uncertainty will be much less apt to embarrass us if during two or three preliminary visits of the patient we carefully study the deformity, accurately plan the details of our operation, and when the time of action arrives carry them out with little or no modification. It is to render hurry unnecessary and to ensure completeness that general anæsthesia is to be preferred in the majority of these cases. In order that the reader may choose for himself I give here a brief outline of the technique of the Asch operation. His instruments (Figs. 46, 47, 48, 49, 50) are two

pairs of scissors or cutting forceps and a strong compressing forceps. In addition there are two separators—one blunt, the

FIG. 46.



Asch's straight septum scissors.

FIG. 47.



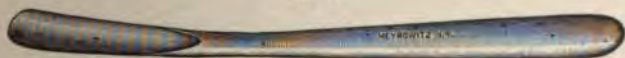
Asch's curved septum scissors.

FIG. 48.



Asch's compressing forceps.

FIG. 49.



Asch's blunt separator.

FIG. 50.



Asch's sharp separator.

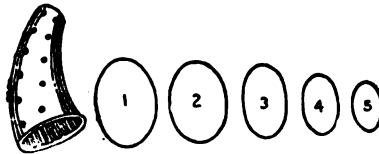
other sharp. These are intended to break through any adhesions that may exist between the deflected septum and the turbinated

bodies of the stenosed side, and to detect and perhaps destroy any obstructions that may be situated posterior to the principal deformity. A set of tubular splints also accompanies the outfit, these having a number of perforations intended both to provide for drainage and to lessen the liability of the tube to slip from its place.

FIG. 51. FIG. 52.

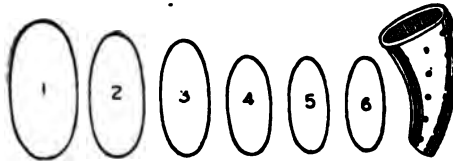


FIG. 53.



Asch tube.

FIG. 54.



Mayer tube.

The operation is preceded by the usual preliminaries. As a rule, general anæsthesia is desirable, and the recumbent posture, with the head hanging low, is to be preferred. Sterilization not only of the instruments but of the patient's nasal fossæ and the operator's hands is always to be observed. The application also of cocaine and the suprarenal solution will greatly facilitate the operation by preventing any obscuring of the field by hemorrhage.

When the preparations are all completed the blunt separator is introduced into the obstructed fossa and any adhesions broken down. In order to effect this thoroughly it may be necessary at times to resort to the sharp separator. The second step of the operation consists in the introduction within the nose of the scissors. The blades are kept parallel to the floor of the nose, the narrow, blunt one being in the obstructed side and following as closely as possible the line of greatest convexity of the deviation. The other, or cutting blade, enters the opposite fossa. Closure of the blades now makes a horizontal incision through the septum. The straight are now exchanged for the angular scissors, their direction made as nearly a vertical one as possible, and a second incision is made at or near the centre of the first and crossing it at a right angle. The septum having been thus divided the finger is forced into the narrow fossa and the four segments pushed so far to the opposite side that they are completely fractured at their bases and show no disposition to return when the finger is withdrawn. The compressing forceps are now brought into action, the fragments being restored to the middle line and made to override one another. This completes the operation, and the cleansing of the cavities and insertion of the splints is all that remains to be done. The treatment of the nose during the ensuing three or four weeks has already been described.

It will be seen that the results obtained by the two methods are identical, and that the choice between the instruments of Asch and the perforator and knife of Douglas is merely a matter of individual preference.

CHAPTER IX.

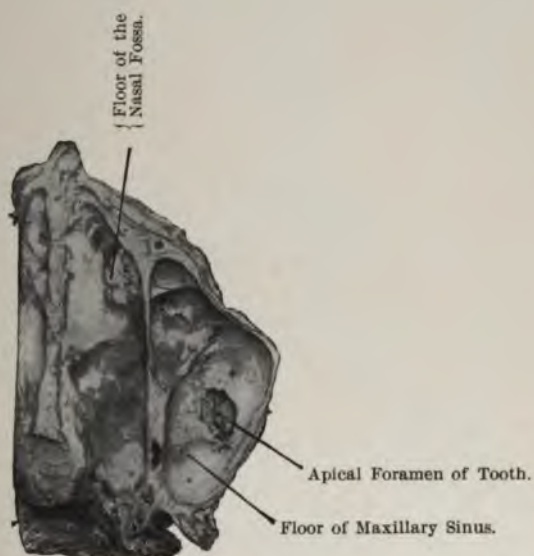
DISEASES OF THE ACCESSORY CAVITIES OF THE NOSE.

OF the four sinuses communicating with each nasal fossa the one most frequently the seat of disease is the maxillary sinus or antrum of Highmore. Its opening, the *ostium maxillare*, situated in the middle meatus of the nose, is concealed from direct inspection by the overhanging middle turbinate. It is so small that but little swelling of the mucous membrane about it or of the adjoining turbinate is required to close it. In a nose with congenitally narrow fossæ, or in one that contains a hypertrophied middle turbinate, this intermittent closure is a very common occurrence. In these a simple acute inflammation of the nose is generally sufficient to obstruct more or less the outlet of the antrum, and so to interfere with its means of drainage. This complication is attended by a sense of pressure and usually much pain in the upper portion of the nose, which remits every now and then when there is a momentary subsidence of the swelling that permits the escape of the retained antral secretion. As the result of traumatism or of a direct extension of inflammation from the nose we may have an

ACUTE ANTRAL SINUSITIS.

Its symptoms include a sensation of heat over the region of the cavity, or persistent dull pain with occasional exacerbations of a neuralgic character, and when the ostium can give it exit a nasal discharge varying in character from seromucous to mucopurulent. There may be also some tenderness of the teeth that are in contact with the floor of the inflamed sinus. The inflammation may involve but one or both of the antra. It is a very frequent accom-

PLATE V.



Horizontal section above the right floor of the nasal fossa and maxillary sinus, showing the opening of a dental abscess in the floor of the antrum. (Cryer.)

paniment of the severe rhinitis of influenza, of the catarrhal form of *grippe*, or of the exanthemata. If drainage through the ostium be maintained the attack will usually subside with or shortly after the rhinitis that preceded and provoked it; but prolonged closure of the ostium, with consequent retention of the antral inflammatory contents, may end in abscess. Accompanying this there will be marked increase of pain, external swelling, and some elevation of temperature. If no artificial relief be afforded nature will make an exit for the pus by one of several routes, these ending either externally upon the face or internally at some point within the buccal cavity.

CHRONIC ANTRAL SINUSITIS.

This will either be the sequel of an acute attack such as the foregoing or it may be of low-grade chronic type from the time of its onset. Its causes, in the vast majority of cases, are either of nasal or dental origin. Any suppurative process within the nose, such as that of purulent rhinitis or atrophic catarrh, or that which accompanies the presence of mucous polyps, may invade the antrum, and not infrequently does so; but probably some dental mischief is responsible for much the larger number of cases of this disease. The bicuspid and premolar teeth are usually the ones at fault. The roots of these are either in close proximity to or in immediate contact with the lining mucous membrane of the antrum, and disease of them will almost inevitably lead to more or less irritative hyperæmia of this structure. If the normal outlet of the cavity is free, and permits the easy escape of the increased secretion, we may have no more than a simple catarrh; but if there be narrowing or frequent closure of the ostium by intranasal swelling, or if some infective agent finds entrance into the cavity, the simple may become a suppurative catarrh.

Symptoms. The symptoms of this chronic antral empyema are similar to but less severe than those of the acute inflammation.

The same dull ache over the cavity is present, the tenderness on pressure, the nasal discharge. Much of this latter passes back into the nasopharynx, and the patient's sense of smell being unaffected he complains of its somewhat offensive odor and as well of its unpleasant taste. It is a yellowish, creamy pus, corresponding to that variety commonly known as "laudable." If it is abundant and much of it is swallowed there is apt to be some gastric disturbance, and the patient's general nutrition will be impaired.

Diagnosis. The diagnosis is not, as a rule, difficult. It is only in exceptional cases that we are compelled to resort to transillumination and perhaps to tapping of the sinus in order to confirm our suspicions. When these have been aroused by the patient's history we may inspect first the condition of the teeth that are in relation to the cavity. If one or more of them are missing we will inquire as to the cause of their loss and ascertain if the beginnings of the suspected antral trouble were about coincident with the dental disturbance. If we discover the presence of a carious tooth the probability of antral inflammation is strengthened. It is not necessary that the root itself be diseased, it having been shown that a diseased crown is quite sufficient to provoke suppurative inflammation within the adjoining sinus. Having disposed of the teeth we examine the nose. If the middle meatus is in plain view we may at once detect pus in the interval between the middle turbinate and the outer nasal wall. If this recess be hidden, however, by swelling of the lower turbinate this is to be reduced by cocaine, and the applicator carried also up to the middle turbinate and along its outer surface as far back as the ostium maxillare. If no pus be found and there is no apparent obstruction of the ostium the patient should be told to lean forward, lower the head between the knees and turn it over upon one side, the affected side being uppermost. The object of this manœuvre is of course to afford the opportunity to any retained pus to gravitate into the nose. If these methods fail,

however, to bring any fluid of a purulent nature into sight we may continue our investigation by employing transillumination of or by tapping the antrum. For the former, the necessary electrical apparatus being at hand, the room is made absolutely dark, a one or two candle-power lamp introduced within the mouth, and the lips closed. The general diffused glow that this should give over the upper portion of the face, with a particularly distinct infra-orbital crescent of translucency, will be marred, should pus be present in one antrum, by a deep shadow beneath the eye of that side. This test is not infallible, however, other conditions than an empyema being able to produce a closely similar shadow.

It is only with extreme rarity that exploratory opening of the antrum need be practised. I have never found it necessary. If after the employment of the other aids to diagnosis some doubt still remains a week or two of careful observation of the nose should certainly enable us to decide as to the existence or non-existence of an empyema.

Treatment. The cause of the disease will naturally influence to some extent our choice of treatment. Whether it be due in one case to nasal and in another to dental irritation, in each it will be advisable to remove the cause previous to treatment of the antrum itself. This having been done the attempt should always be made to first treat the sinus through its natural opening. Before this can be accomplished it is frequently necessary to effect some intranasal improvement. Septal deformities, if they prevent our reaching the ostium, must be removed, and mucous polyps or turbinate hypertrophies must also be cleared from our path. At times it may be necessary to remove a small portion of the middle turbinate itself, and this is far preferable to the extraction of a sound tooth or an extensive opening of the antrum through the canine fossa. A very convenient syringe for reaching the opening in the middle meatus is an ordinary dental syringe, with a longer and more slender nozzle than that shown in the illustration. (Fig. 55.) The tip of this may be altered at will and the

whole tube bent to any desired curve. A warm boric-acid solution does very well to wash out the cavity, and this may be followed by a more actively antiseptic solution, such as phenoline or borolyptol in appropriate dilution. This may be repeated once or even twice daily for the first week, and then as the discharge diminishes the cleansing may become less frequent. If astringents are employed they should be in mild strength, the chloride of zinc gradually increased in strength from a 1 per cent. solution being more often satisfactory than any of the others. If at the end of two weeks no decided impression seems to have been made upon the suppurative process, we should prepare to enter the

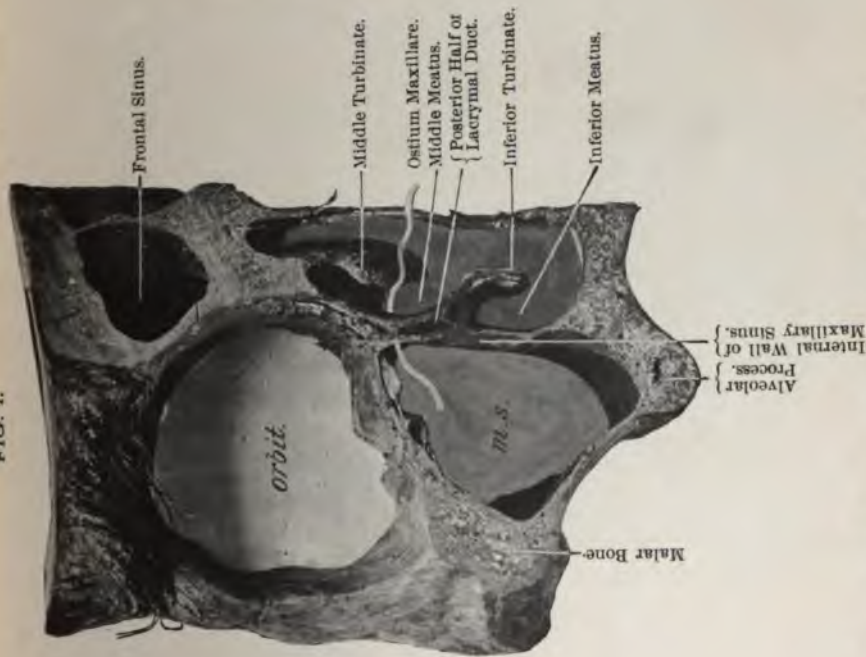
FIG. 55.



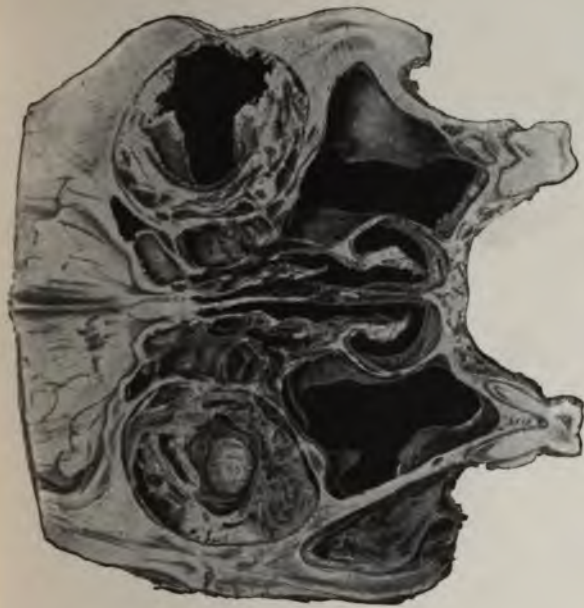
Syringe for washing out the antrum.

cavity by means of an artificial opening. Where shall this be made? We may choose from among three localities, surgical common-sense dictating the selection of the lowest of these when practicable, for reasons that affect the completeness of drainage. The first of these is the inferior nasal meatus. The bony wall separating the antrum and nasal fossa is here quite thin, and can be easily penetrated by a curved bayonet-pointed knife or a similarly curved trocar. When the nasal chamber is roomy enough to permit of their introduction, a spot as nearly as possible directly beneath the ostium is cocaineized and the puncture made well up beneath the inferior turbinate, the bone being thinner here than close to the floor. The few advantages of this route of

FIG. 1.



Anterior view of a vertical transverse section of the right side of face. (Cryer.)



Posterior view of a vertical transverse section near the first molar teeth, showing maxillary sinuses which are nearly cuboidal in shape and which extend downward below the floor of the nasal fossæ. The nasal chamber is narrow, and the walls dividing it from the sinuses are concavo-convex in their vertical direction. (Cryer.)

entrance are outweighed by its many defects. The greatest of these latter is that the antral floor is almost always some little distance below the level of the opening, and drainage, therefore, is incomplete to that extent. It is true that the opening may be kept patent, and that the more intelligent patient may be taught to wash out the cavity himself; but, in spite of assertions to the contrary, this is not easy, and it is liable to be painful as well as annoying. Moreover, if the cleansing and medication of the sinus through its natural opening has failed to check suppuration it is scarcely likely that they will be any more effective through this one, and at best the treatment will be greatly prolonged and exhausting to one's patience.

Either of the two remaining methods is greatly to be preferred to this; and of these two—the alveolar and the supra-alveolar—

FIG. 56.



Alveolar drill for entering antrum.

the first is the better if thorough drainage is all that is desired, and if a sound tooth need not be sacrificed to obtain it. In case one of the bicuspid or premolars is missing, or if one of them is carious and the patient will be none the worse for its removal, there will be no obstacle to the employment of this method. A hand drill (Fig. 56) will easily enable us to open a channel from the lower border of the alveolus into the antrum, and this will usually enter it at its most dependent point, thus satisfying the surgical rule concerning incisions for purposes of drainage. Through this opening the antrum can be easily cleansed once or twice daily by the patient, it being kept patent by a flanged soft-rubber tube or a metal one attached to the neighboring teeth. If a few weeks of faithful treatment of the disease through this opening does not succeed in curing it, we may be assured that

such changes have occurred in the lining membrane of the cavity as will defy anything less than a radical operation under ether for their removal. Let it be understood that half-way measures are worthless. The only operation that can be wholly satisfactory is the making of an opening in the anterior bony wall of the antrum of such extent as will permit thorough inspection and direct treatment of the diseased mucous membrane. The

FIG. 57.



Antral drainage-tube.

curetting of this, the application to it of solutions of formaldehyde or chloride of zinc, and the packing of the cavity with an antiseptic gauze, changed as often as may be advisable, can scarcely fail to be, within a reasonable time, completely successful. Anything surgically short of this, however, will result in protracted treatment and almost inevitable disappointment.

SUPPURATION OF THE FRONTAL SINUSES.

Purulent inflammation of these cavities is quite frequently found in association with severe acute rhinitis, and it is announced by pain of a "neuralgic" character over the site of the sinuses, and perhaps by some cellulitis of the upper lid and general swelling of the periorbital tissues. If there be much obstruction of the infundibulum by hypertrophy of the middle turbinate or through the presence of polyps the suppurative process is apt to become chronic. In addition to the throbbing pain, the tenderness on pressure, and during periods of infundibular obstruction the appearance of some swelling over or about the site of the cavity, we will usually discover by means of anterior rhinoscopy some pus in the vicinity of the *bullu ethmoidalis*. This if brushed

away is apt to quickly reappear, and if we can exclude suppurative ethmoiditis there should be no difficulty in reaching a correct diagnosis.

Treatment. Treatment will consist in the removal of anything that can occasion obstruction of the natural outlet of the sinus, and it can then be catheterized and cleansed with an antiseptic solution. If in spite of a daily repetition of this for some days or a few weeks the disturbance persists, trephining of the cavity and curetting of its diseased mucous membrane, with perhaps the subsequent insertion of a drainage-tube which will enter the nasal chamber, may become necessary. The preferable operation is that in which the skin of the brow is drawn upward and the incision made just below the supra-orbital ridge. It should extend from the supra-orbital notch to the inner angle of the orbit. The edges of the wound being separated as widely as possible, and the bone exposed, a small trephine is employed to open the cavity. After cleansing with an antiseptic solution all carious or otherwise diseased tissue is removed by the curette, the fronto-nasal duct is well dilated, and a self-retaining drainage-tube inserted. The wound may now be closed and the further treatment conducted through the nose.

CHRONIC SUPPURATIVE ETHMOIDITIS.

Chronic disease of the ethmoidal cells is of occasional occurrence, and is attended by pain in the forehead or at the top or back of the head. Inspection of the nose will lead to the discovery of pus anteriorly in the middle meatus or posteriorly descending from the superior meatus. The middle turbinate will usually have undergone a polypoid degeneration, and an abundance of granulation tissue will be found in its neighborhood.

Treatment of this condition, to be successful, must be energetic and unremitting. It usually involves the removal of the anterior extremity of the middle turbinate, the opening of the *bulla*, and

the extensive and vigorous curetting of the cells. Daily cleansing and holding in check of any tendency to the excessive growth of granulation tissue will probably be essential for some few weeks afterward.

SPHENOIDAL SINUSITIS.

This affection is announced by persistent pain, usually referred to the vertex, by mild vertiginous sensations, and by the presence of pus upon the posterior pharyngeal wall. If the symptoms are of such severity as to justify operative interference there need be no hesitation in opening the sinus to an extent that will permit of its thorough cleansing and medication. When the nasal chambers are of average roominess, and the turbinates are contracted by applications of cocaine and the solution of the suprarenal extract, the anterior wall of the sphenoidal sinus can usually be inspected without difficulty, and an artificial or an enlargement of its natural opening may be made without exposing the patient to any risk. A drill of appropriate length and slenderness is employed and the opening made about upon a level with the posterior extremity of the middle turbinate. If the drill be not permitted to enter the cavity to any distance beyond the opening made by it the danger of invading the cranial cavity is scarcely worth considering.

PLATE VII.

FIG. 1.



Antero-posterior sections, showing where they were cut apart through the frontal sinus, the hiatus semilunaris, the bulla ethmoidalis, and the posterior ethmoidal cells. (Cryer.)

FIG. 2.



External walls of right and left nasal chambers, with large sphenoidal sinuses, B having four meati. (Cryer.)

CHAPTER X.

THE NASOPHARYNX.

THE intimate anatomical and physiological relations of this cavity to the nasal fossæ, the ears, and the lower pharynx should always be remembered in studying and treating its diseases. Its position with reference to both the digestive and respiratory tracts is the very opposite of an isolated one, and it is, therefore, a clinical sequence that any pathological process in it will be shared to a greater or less extent by the adjoining passages.

ACUTE NASOPHARYNGITIS.

It is extremely seldom that any acute inflammatory process originates here. It is almost invariably secondary to disturbances of the nose or of the lower pharynx. The condition which most actively predisposes to the occurrence of acute inflammation in this cavity is the presence of a chronic catarrhal process, and the other predisposing and exciting causes are precisely those that have been mentioned under the etiology of acute rhinitis. The *symptoms* are not very distinctive, because they are usually overshadowed by those of the accompanying coryza or pharyngitis. During the first twenty-four hours, however, a sense of aching and extreme dryness in this region is usually complained of, and various uncomfortable sensations in the ears are of common occurrence. A little later secretion is re-established, rapidly becomes excessive, and masses of thick, yellowish mucus will be seen passing down the walls of the oropharynx from the cavity above. This occasions frequent swallowing movements, hawking, and even gagging. There is no difficulty in *diagnosis*, nothing pecu-

liar in its *pathology*, and the *prognosis*, in the absence of complications, is favorable. *Treatment* differs very slightly from that of acute rhinitis. The general treatment is the same—the laxative, the restricted diet, and the general medication directed to any factor of a constitutional or diathetic nature. The local treatment should be conducted almost exclusively through the nose. The turbinates are slightly cocaineized, so as to give us a roomy approach to the nasopharynx, and then this space is sprayed again and again with warm Dobell's solution until the last shred of tenacious mucus has been washed away. The applicator, with its cotton-covered tip wet with the same solution, may gently assist in this cleansing process, but no syringing of the postnasal space should be attempted from below, nor should any application be made to its inflamed and intensely sensitive mucous membrane by this route. When it has been rendered quite clean, the 1 to 4 solution of hamamelis, also warm, may be used, and this followed by the application to the pharyngeal wall through the nose either of a 10-grain silver solution or of the menthol and camphor combination with albolene (page 87). The silver should be used only in case the nasal fossæ are capacious and will permit of its being carried through them without coming in contact with their own lining membrane. This treatment should be repeated daily by the physician, and the patient should be instructed to spray the nose at frequent intervals throughout the day and evening, and to draw all of the solution back into the nasopharynx and allow it to pass downward into the mouth. A week of such treatment should bring to an end an uncomplicated acute nasopharyngitis.

CHRONIC NASOPHARYNGITIS.

This condition, commonly known as "postnasal catarrh," probably brings more patients to the throat specialist than any other. The aurist also owes the larger part of his practice to this affection. It is wellnigh universal in this country. It may

be so insidious in its beginning and slow in its progress that many of its victims do not awake to its presence until it is well established. It is almost invariably associated with some nasal abnormality to which it is secondary. Any of the several forms of nasal catarrh, if unchecked, will lead inevitably to a similar process in the nasopharynx, and the chronic inflammation in this region will be encouraged or restrained by the same external and internal conditions which influence the nasal disease. Of the *symptoms*, the one above all others that distinguishes the affection is the sensation of some foreign substance within that space, or, as the average patient expresses it, "between the throat and the nose." It is this which excites the movements of swallowing, and these, failing to dislodge the mass of mucus, are followed by that expulsive effort termed "hawking," and this perhaps by gagging and even in severe cases by vomiting. The first hour or two in the morning after rising is usually the time when the disease creates the greatest amount of disturbance. It is then that the overnight accumulation of viscid mucus in the nasopharynx begins to descend and occasions the violent gagging and retching that seriously interfere with the digestion, and threaten even the retention of the morning meal. Throughout the whole day, however, the sensation as of something "dropping" from the head into the throat is experienced more or less continuously, and the patient is annoyed, and particularly in public, by the frequent and irrepressible desire to clear the throat. The frequent repetition of this act is causative of much congestion and relaxation of the velum and uvula, and this condition materially adds to the throat discomfort. In quite a large proportion of these cases of postnasal catarrh the Eustachian tubes participate in the disease, and in the course of time the middle ears do likewise. As a consequence, complaints of fulness in the ears, impaired audition, and tinnitus are the rule rather than the exception. It is not at all surprising that more or less gastric disturbance of a catarrhal nature is another common accompaniment. The quan-

tities of mucus that are swallowed delay digestion, lessen the appetite, and lower general nutrition. A final symptom that is worthy of note is the alteration in the quality of the voice. There is loss of resonance and steadiness, and it is apt to tire quickly. The singing voice is even more seriously crippled by this disease.

Pathology. The pathology does not differ materially from that of catarrh of the mucous membranes generally.

Diagnosis. The diagnosis should be a matter of no difficulty. The history and symptoms related by the patient, followed by inspection of the cavity with disclosure of its reddened and thickened mucous membrane extensively covered by the excessive catarrhal secretion, are quite enough to dispel doubt.

Prognosis. Prognosis as regards ultimate cure is favorable enough, but this often requires protracted treatment which should even be continued for some time after cure has been apparently obtained. Carelessness and irregularity on the part of the patient will greatly prolong treatment and increase the liability to recurrence, and therefore it is as well for the physician not to be too optimistic in his predictions.

Treatment. At the very outset all causes of internal origin should be neutralized as completely as possible. The whole digestive tract should be cleansed, its glandular appendages aroused to normal functional activity, and any systemic poisoning from this source restrained. Especially should any tendency to constipation be combated, and rather by appropriate regulation of diet and exercise than by the administration of drugs. In men strict temperance, or perhaps total abstinence with regard to both alcohol and tobacco, should be insisted upon. The intimation is scarcely needed that any condition within the nose or in the lower pharynx that might favor the persistence of the catarrhal process in the nasopharynx should receive active attention.

The local treatment to be successful demands judgment in its selection and skill and thoroughness in its application. It would

be very bad judgment, for instance, to apply to an irritable and oversensitive upper pharynx a solution of iodine, however weak it might be. It would be better practice to reduce the hyperæsthesia first by some remedy of a sedative and astringent nature, and later to substitute for it a stimulant alterative like iodine. "Make haste slowly" is an excellent general rule to observe in the early treatment of the victims of this disease. The thorough cleansing of the nasopharynx as a preliminary to the application of any medicament is apt to require some little time and patience. The contained mucus is apt to prove tenacious, and is not to be swept away by the ordinary spray. Any obstructive swelling within the nasal fossæ is first reduced by the application of the weak (2 per cent.) cocaine solution, and then the Dobell is vigorously sprayed through the nose back to the pharyngeal wall, and applied to it also, perhaps, upon the cotton-carrier by the same route. In the better-trained and more tolerant throat, but only in this, the curved nasopharyngeal applicator, introduced through the mouth, may aid in this cleansing process.

I do not advocate the employment of the postnasal syringe. Perhaps in an atrophic nasopharyngitis where there are actual incrustations of dried mucus and the tissues are comparatively insensitive its use may be permitted; but it is, as a rule, both extremely unpleasant to the patient and not nearly so effective as the method of loosening the mucus by one or the other form of the cotton-wound applicator. All inspissated secretion having been removed, the witch-hazel solution may now be used like the Dobell, through the nasal passages, and the 10-grain alum solution sprayed through the open mouth upon the lower pharynx and the relaxed velum and uvula. At the first sitting or two this treatment may be completed by the application to the pharyngeal wall and vault, again through the nose, of the camphor, menthol, and benzoïnol combination. At the second the Boulton solution may supplant it and be applied in the same way, and a visit or two later we may venture to give this cavity its

first experience with the weak iodine solution. The smarting and temporary increase of congestion and swelling occasioned by this are apt to be decidedly unpleasant; but they do not usually last for more than an hour or two, and after a few repetitions of this application, at intervals of every second or third day, its disagreeable effects become much less noticeable. Within varying periods of time the quantity and viscosity of the catarrhal secretion will lessen, the throat, becoming less sensitive, will be more tolerant of its presence, and the morning gagging and the hawking throughout the day will greatly diminish and gradually disappear. In the longer standing and more obstinate cases the strength of the iodine solution may have to be increased; but the ultimate result, though delayed, will be equally satisfactory. In occasional cases, particularly alcoholics and excessive smokers, where the hyperæmia is active rather than sluggish, and in whom, also, hyperæsthesia is more marked than is commonly the case, we may find that nitrate of silver or chloride of zinc in 10 or 20-grain strength seems to have a happier effect than the iodine. But no one of these various solutions should be used in a rigidly routine way throughout the whole treatment of the case. In all probability it will happen quite often before complete cure is obtained that, owing to various disturbing influences, of either external or internal origin, the vascular and glandular activities of the affected mucous membrane may undergo temporary alterations. We should always have an eye to these; at each succeeding visit of the patient the nose and nasopharynx should be examined with the same care that we employed at the first; the local applications should be varied and adapted to each variation in the local condition, and we should never permit ourselves to fall into a therapeutic rut from which no merely temporary pathological alteration can tempt us to depart.

HYPERTROPHY OF THE LYMPHOID TISSUE IN THE VAULT OF THE PHARYNX.**Adenoid Growths—Postnasal or Lymphoid Vegetations.**

This affection is described also as hypertrophy of the pharyngeal or Luschka's tonsil. The mass of lymphoid tissue in the upper central portion of the posterior wall of the nasopharynx is always the original site of the disease, but under favoring conditions the discrete lymphoid follicles in the immediate neighborhood may be included in the hyperplastic process.

Etiology. There is scarcely any affection of the upper air passages to which a larger number of contributing causes has been assigned than this. A list of the more prominent includes heredity, age, sex, the strumous and lymphatic diatheses, frequent colds, obstructive nasal affections, the exanthemata, micro-organisms, climatic and social conditions, the latter at times involving insanitary surroundings. Granting, however, that one or several of these are distinctly active as etiological factors in the majority of cases, yet the closest analysis will fail to discover that any one of them is essential to the development of this disease; in other words, we are entirely unable to draw from the wealth of clinical material at our command anything more than general deductions. There is nothing definite or precise in our information concerning the ultimate causes of the pathological process. As a fundamental fact, we know that in early life the epithelial and lymphoid tissue elements are particularly prone to be affected by the catarrhal and hyperplastic processes. Any condition, be it external or internal, that encourages a persistent catarrhal hyperæmia of the upper air passages in the infant or child, such as frequent coryzas or repeated inflammations of the faucial and pharyngeal mucous membrane, or continuous exposure to unfavorable hygienic surroundings, will favor the occurrence of adenoid growths. The greater functional activity of the general

lymphatic system and the normally greater proportionate development during childhood of the various lymphoid structures throughout the body make them the more liable to pathological alterations as the result of such maleficent influences as those just named. This leads to the statement, already anticipated, that this disease is one of early life. Averaging the results obtained from the examination by several observers of many thousand school children, we find that about 2 per cent. of them were the subjects of this postnasal growth. It is also of statistical establishment that the period during which this disease is of commonest occurrence is that between the third and fifteenth years. It is far, however, from being limited to this period, since it has not only been occasionally observed at birth, but has been seen as well in patients in their sixth decade of life. Sex seems to have but very little determining influence upon the beginning of the disorder.

It is a matter of common belief that these growths tend to undergo a spontaneous atrophy about the age of puberty. The subsidence of symptoms, however, which, it is true, is not uncommon at this period, may be due not to an actual shrinkage of the vegetative mass, but to the rapid increase in the capacity of the nasal and nasopharyngeal cavities which also occurs at this time of life. Nevertheless, we know that the natural tendency of the various lymphoid structures at this stage of development is to undergo retrograde changes. The gradually lessening lymphatic activity which marks this transition period is accompanied by obliterative changes in the blood and lymph vessels, and there is extensive pressure atrophy of the follicles, due to the maturing and inevitable contraction of the connective tissue. Under a normal course of events this steady diminution and final disappearance of the adenoid hypertrophy would probably always take place; but if a persistent catarrhal hyperæmia of this region is maintained by unwholesome hygienic conditions, some inherited systemic taint, or one or more of several other causes, the growth,

instead of being arrested, will keep pace with the developmental expansion of the cavity, and be found as proportionately large in the youth or adult as it has been in the child.

The influence of climatic peculiarities is evidenced by the greater frequency with which these vegetations are found in those regions where abrupt changes in temperature and atmospheric humidity are of common occurrence. These act, doubtless, through their encouraging effect upon catarrhal processes in the upper air passages. Any pathological state of a constitutional nature which will likewise promote vascular congestion of the mucous membranes will also become of etiological significance in the history of these growths. The tubercular and syphilitic dyscrasiæ, struma, and the rheumatic and gouty diatheses are to be classed in this category, and their influence doubtless arises from their disturbing effect upon normal nutritive processes. They also predispose the individual very strongly to frequently recurring acute or subacute attacks of catarrhal inflammation. This same predisposition is created by certain nasal abnormalities, the more common of these being turbinate hypertrophy and septal projections or deflections.

Finally, we are not to leave unnoticed the directly exciting influence of certain of the micro-organisms. Our attention is so frequently called to the fact that the rapid development of adenoid growths dates from an attack of influenza, whooping-cough, diphtheria, or one of the exanthemata, that we cannot be blind to the etiological responsibility of the bacterial agents peculiar to these diseases. Whether the intense irritation of the highly impressionable lymphoid cells is to be referred to the organisms themselves or to the toxins which they secrete is immaterial. The result in either case is the same—the rapid proliferation of these cells and a proportionately rapid increase in the size of the pharyngeal tonsil.

Symptoms. The mouth-breathing and the alteration in the quality of the voice are the most striking evidences of the pres-

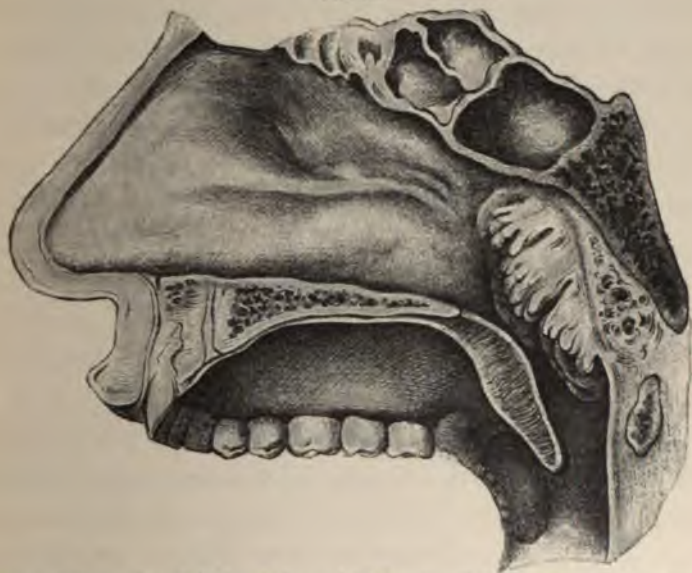
ence of these vegetations. The posterior nares are usually closed with sufficient completeness by the mass of tissue to necessitate constant mouth-breathing. *Respiration* is apt to be noisy enough even while the child is awake; but during sleep, when the tongue and relaxed velum are always more or less in the way of the air current, the noises made by the child are apt, to a nervous mother, to be almost terrifying. The character of the adenoid *voice* is closely similar to that which accompanies intranasal obstruction, but its lack of resonance and color is even more marked. Owing partially, also, to the paretic palatal muscles, there is, in addition, a thickness and indistinctness of articulation which make the *speech* at times almost unintelligible.

The aspirated consonants suffer, *b* and *d* replacing *p* and *t*; and nasal expiration being essential to the production of *m* and *n*, these letters also are impossible, and *b* and *d* are likewise substituted for them. The characteristic *facial expression* is that of extreme mental dulness, the wide-open mouth and the half-open, lack-lustre eyes robbing the face of any intelligence it might otherwise possess. Another cause contributing to this appearance of stupidity is the greater or less degree of *deafness* that is almost always present, and that is due, as will be readily surmised, to the tubal catarrh or to the direct Eustachian obstruction occasioned by the growths. *Aprosexia* is the name that has been given to this mental state, which renders quite impossible intellectual effort of any degree or duration. An objective symptom of some value is the very common depression of the alæ nasi and the consequent narrowing of the nostrils—a featural alteration which has the effect of making the bridge seem abnormally wide. Examination of the throat discloses in the greater number of cases some concomitant enlargement of the faucial tonsils and a pharyngeal wall that is studded with several small, discrete follicular hypertrophies or one or two confluent masses of them. These are larger and more prominent as they approach the upper pharynx,

and are very significant of the hyperplasia of the lymphoid structures in the vault. (Fig. 58.)

Pathology. Adenoid growths are composed of lymphoid tissue, and are almost identical in structure with the faucial tonsils. The tissue is of a retiform, connective type, and contains numerous trabeculæ, the spaces formed by them being filled to repletion with lymph cells. They are very vascular, and the character of the tissue as a whole makes it extremely prone to hyperplasia upon slight provocation.

FIG. 58.



Antero-posterior section of the head of an adult, showing the situation and gross structure of hypertrophy of the lymphoid tissue of the nasopharynx. (ZUCKERKANDL.)

Diagnosis. There is neither difficulty nor possibility of error in this. The symptoms of themselves are usually quite sufficient for diagnostic purposes, but if there be a shadow of doubt the examination of the nasopharynx will remove it at once. This may consist of direct inspection of the cavity by either posterior or anterior rhinoscopy or by the introduction into it of the finger. If the child or youth be sufficiently tractable to permit the suc-

cessful use of the rhinoscopic mirror, the vegetations are seen to project downward from the vault and forward from the posterior wall of the pharynx, forming a single mass which more or less completely fills this postnasal space. It is usually deeply fissured or lobulated, rather paler in color than the normal mucous membrane, of somewhat œdematous appearance, and perhaps extensively covered by an abundant secretion of mucus.

In the event of failure to obtain a satisfactory postrhinoscopic view we may very often resort with entire success to direct inspection through the anterior nares. The turbinates are first reduced by the application of a 2 per cent. cocaine solution, and a speculum as large as the vestibule will admit is then introduced. With good illumination the color and irregular surface of the growths can be distinctly seen, and if the patient be directed to swallow they will be lifted and projected forward into the nasal chambers by the elevation of the palate.

FIG. 59.



Guard for finger.

Should neither of these methods be completely satisfactory, or if we should wish to ascertain the density and the extent of attachment of the growths, we may have recourse to the digital examination. It is better, I think, with older children to prepare them for what is about to happen, so that, although they may be hurt a little, they will not be unduly frightened. If the physician stands at the child's right side it is his right hand that is used for the examination, and *vice versa*. One hand, then, being placed back of the child's head, steadies it; while the index finger of the other, protected from being bitten by a rubber or metal guard (Fig. 59) covering the proximal phalanx, is introduced within the open mouth. It is hooked back of the velum and sent up into the nasopharynx, hugging the lateral wall of the pharynx as

closely as possible. This route is advised because the soft palate is less firmly applied to the pharyngeal wall at the sides than in the middle line, and it is much easier to go around than over the prominences of the cervical vertebræ. Having entered the cavity, the beginner will probably find it best to bring the finger to the centre and locate the posterior border of the septum. With this as a guide the finger-tip may be moved from side to side, the Eustachian prominences palpated, and an accurate idea of the extent of the mass gained. It is scarcely worth while to describe the sensation that these vegetations impart to the finger, one examination being worth more than all the descriptions ever written. They are soft and slimy, however, and the gentlest pressure is sufficient to make them bleed, so that when the finger is withdrawn it is usually coated with a blood-stained mucus.

Prognosis. Unless we except the few subjects of hæmophilia, there is seldom anything to interfere with the entire removal of these growths and the disappearance of all the symptoms occasioned by them. If they have been of such size and have existed for so long a time, however, that the normal development of the nasal cavities has been seriously interfered with, or if prolonged Eustachian obstruction has resulted in profound structural alterations within the middle ear, we must not be oversanguine in our predictions concerning the subsequent correction of these injuries. It is no exaggeration to say that, as a rule, the postoperative improvement in the child's mental and physical condition, both in its rapidity and extent, is little short of the miraculous; but when the nasal alæ have collapsed and the fossæ are dwarfed as the result of disease, and where, again, extensive catarrhal changes have occurred in the mucous membrane of the middle ears, accompanied, perhaps, by firm ankylosis of the ossicular joints, we cannot reasonably expect nor confidently predict that these advanced pathological conditions will promptly vanish upon the removal of the adenoids. We need not banish the hope of an ultimate result of this kind, but, on the other hand, we should

not commit ourselves to promises that we may later find ourselves incapable of fulfilling.

As to the recurrence of these growths when they have been once thoroughly removed, it is, to say the least, extremely unlikely. In those cases in which their reappearance has been observed we may justly suspect that the operation has been incomplete. It usually happens that any fragments that may have been left behind undergo a more or less complete atrophy; but if the original provoking causes are allowed to continue unrestrained by subsequent general or local treatment, then it is quite possible that these remnants may again reach the size of the mass that was supposed to and ought to have been wholly removed. A result such as this, due to negligence, is far from being a recurrence in the strict sense of the word.

Treatment. If the pharyngeal tonsil has attained a size sufficient to cause noticeable interference with nasal breathing, little or nothing can be hoped for from merely palliative treatment. The application to it of astringent pigments through the nose or by way of the mouth is a waste of time. Operation should only be postponed long enough to get the child into good local and general condition. The choice of method in operating will be affected by the age, temperament, and tractability of the child, and by the size and density of the lymphoid growth. These elements will determine, in the first place, whether or not we shall employ local or general anæsthesia. It is an invariable rule with many operators to use only general anæsthesia. I permit myself, however, occasional exceptions to this rule. In quiet, steady-nerved children of six years or over who do not wish to take ether or chloroform, and in whom the mass of hypertrophic tissue is of but moderate size, it is not at all uncommon for me to cocaine the growths both from below and above, and then to remove them by one grasp of the forceps or a single sweep of the curette. The moderate and but momentary pain of this method is, I think, much less objectionable than the fright, the cries and

struggles that often attend the administration of a general anæsthetic. Moreover, the consciousness of the patient entirely eliminates whatever slight danger there may be during unconsciousness, of fatal laryngeal obstruction through the inhalation of blood and fragments of tissue. This possible danger has, it seems to me, been very greatly overestimated; but, nevertheless, we can and may as well avoid it altogether when the type of patient admits of our operating without general narcosis. Immediately previous to the performance of the operation the nose and nasopharynx should be cleansed as thoroughly as possible with an antiseptic solution, and the lymphoid hypertrophy then mopped with a tuft of cotton that has been moistened with a 6 per cent. solution of cocaine. In four or five minutes this may be followed by the application of a 1 to 2000 solution of adrenalin chloride, and a minute later the instrument we have selected, sterilized, may be carried into the postnasal space and the cavity cleared of the offending tissue. There are not a few operators who employ for this purpose no other instrument than the finger. In spite, however, of their assurances that they are able to remove every vestige of the growth in this way, the unaided finger, though it may be successful in detaching any few fragments of tissue that may have escaped the forceps or curette, is seldom sufficient to eradicate a growth that is of even ordinary size or consistence. The pain attending the operation under cocaine anæsthesia is not at all severe, and if the child be tactfully handled previous to and during the operation it will seldom make any outcry or resistance worth mentioning. If, however, the vegetations occupy the greater portion of the nasopharynx and would require repeated introductions of the instruments, and if the patient is apprehensive and lacking in nerve, it will be infinitely better to administer one of the general anæsthetics in order that the operation may be performed with a deliberation that will ensure thoroughness.

Of recent years, chloroform, nitrous oxide, and bromide of

ethyl seem to have made considerable gains in favor as agents for general anæsthesia in adenoid operations; but, in spite of its well-known disadvantages, ether is still and will probably remain the choice of the majority, at least in our own country. The necessity for a skilled anæsthetist for the safe administration of all of the first-named group, and the rather brief insensibility afforded by the nitrous oxide and ethyl bromide are objections to these agents that will continue to deter many from adopting them. It is only the experienced and rapid operator who will find the narcosis of these latter two vapors sufficiently prolonged to enable him to complete his work before the return of consciousness. The obnoxious features of ether may be largely overcome by preceding its administration by that of nitrous oxide.

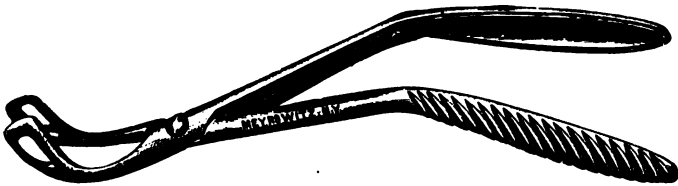
The hemorrhage attending the removal of adenoids is apt to be quite profuse for a few minutes, but it is extremely seldom that it proves at all obstinate. The application of styptics or hæmostatics is scarcely ever necessary, and in case the hemorrhage should be a little more prolonged or profuse than usual an iced spray of sterilized water will in all probability prove quite sufficient to arrest it. It is true that a dozen or more of fatalities due to hemorrhage attending this operation have been recorded, but some anomaly of vascular distribution or the hæmophilic diathesis has probably existed in most of these, and if we are, as we ought to be, careful to exclude such from surgical interference we will not be likely to encounter any trouble from this source. A certain amount of hemorrhage is, however, unavoidable, and if it is proposed to carry anæsthesia to the point of abolishing the laryngeal reflex we must take some measures to prevent blood from entering the larynx. The one usually adopted is to have the patient's head lower than the rest of the body. In this position the blood, not being able to run up hill to the larynx, will escape by way of the nose and the mouth.

Profound narcosis is, I think, not only unnecessary, but, for several reasons, objectionable. Respiration will be much better

throughout the operation if anæsthesia is brought just to the point of complete insensibility to pain and there stopped. Aside from the question of the patient's safety, the preservation of the laryngeal reflex will be of advantage to the operator, in that the frequent cough will throw the blood and mucus forward into the mouth, from which they can be readily removed and the field cleared by sponging. Under moderate anæsthesia there will also be less venous engorgement, and therefore less hemorrhage, and its entire cessation will follow the conclusion of the operation much more promptly.

Immediately upon the suspension of the anæsthetic, a gag, more or less similar to the one illustrated (Fig. 66), is introduced, the mouth widely opened, and the instrument afterward held firmly

FIG. 60.



Brandegee's adenoid forceps.

in place by an assistant. The head being now slightly turned toward the window or other source of light, it will be a very useful preliminary to the actual operation to make a thorough digital exploration of the postnasal cavity in order that we may ascertain both the exact bulk of the growth and that portion of the vault or walls of the pharynx to which it is principally attached. The withdrawal of the finger is followed by the introduction of the tongue depressor well back to the base of the tongue, so that the soft palate and pharynx shall be completely exposed to the view. Either the curette or the forceps is then carried back to the pharyngeal wall, slipped upward back of the palate, and raised to the uppermost limits of the obstructing mass. In case the forceps are first used the blades are kept closed until

the upper portion of the growth has been reached, and are then widely separated and pushed strongly backward, so as to include between them as much of the mass as possible. This movement

FIG. 61.



Munger's adenoid curette.

will also carry them away from the posterior border of the septum and lessen any danger of its injury. The blades are now firmly closed and the included tissue detached from its bed by a

FIG. 62.



Introduction of curette.

FIG. 63.



Curette in place.

combined lateral rocking and downward pulling movement. The younger operator is not to be alarmed or disconcerted by the profuse gush of blood that invariably attends this first step of the

FIG. 64.



Downward sweep of the curette.

operation. It is sponged from the mouth and throat, the tongue depressor or finger reintroduced, and the forceps again guided to the remainder of the growth. My own custom is to remove all

that I can of the adenoids in this way, and then to employ the curette for the removal of any fragments that may have escaped the blades of the forceps. Several times, perhaps, during the operation the finger repeats its examination of the nasopharynx, in order to determine not only what has been but what remains to be accomplished. Particular care should be taken to reach with it the very vault of the pharynx and to crush and scrape away those vegetations that frequently extend forward as far as or even beyond the choanæ. Should these be permitted to remain the emptying of the posterior portion of the nasopharynx will prove of little or no practical value in so far as the re-establishment of nasal respiration is concerned. A little device that greatly facilitates the removal of growths in this situation is illus-

FIG. 65.



Finger curette.

trated in Fig. 65. It fits snugly over the tip of the index finger, and is much more effective than even the stoutest finger-nail. Occasionally, also, a number of smaller vegetations are found in the depressions back of the Eustachian eminences, the fossæ of Rosenmuller. These are particularly apt to exert some degree of pressure upon the posterior wall of the tube, and so to interfere with its normal patency. The safest as well as the most efficient instrument for their removal is the finger. The employment of a curette or forceps in this situation is apt to inflict more or less injury upon the tubal eminence itself, and perhaps to provoke a median otitis.

Upon the conclusion of the operation the patient is transferred to his bed, where he should remain until the next morning. Although, if his condition be satisfactory, he may be allowed to

get up on the succeeding day, yet it will be most prudent for him to spend it within doors. At the end of this time, however, weather permitting, he may safely leave the house and soon resume his ordinary pursuits. For the first day or two his food should be liquid or soft, and, what is more important, it should be cool rather than warm. This temperature will prove more grateful to the wounded pharynx, and, at the same time, it will not encourage any tendency to a persistent leakage of blood. In

FIG. 66.



Position of patient during operation for removal of adenoids.

the way of after-treatment the throat need not be molested for at least twenty-four or thirty-six hours. Upon the expiration of this period, however, the nasopharynx should be well cleansed through the nose with a warm alkaline solution, and following this a 10-grain solution of silver nitrate or the officinal glycerite of tannic acid should be applied, also through the cocainized and illuminated nose, to the wounded area. A very few days usually suffice to complete the cicatrization of the wound and the patient's convalescence.

Although with each repetition of this operation its difficulties will be the more easily surmounted, yet, even to the experienced operator, the removal of adenoids is never a perfectly simple matter, nor is it to be performed carelessly and without a proper appreciation of the possible risks that may attend it. The usually profuse hemorrhage is of no consequence in so far as the simple loss of blood is concerned ; but if the patient's head is not sufficiently lowered, or the anæsthesia is too profound, or the assistant is not quick and skilful with his sponges, it will be apt to occasion considerable annoyance, and perhaps some alarm. In this connection it may be intimated that it will always be a great advantage to have as an anæsthetist one who is familiar with the various details of the operation, and who, upon the suspension of the ether, can intelligently care for the position of the head and attend to the removal of the blood and mucus during its performance. The accompanying illustration is intended to show the general position of the patient, the mouth widely opened by the gag, and the introduction of the tongue depressor, in order that the faucial region may be completely exposed. The distinct tendency in one's earlier operations is to stop too soon, to sacrifice thoroughness to an uncalled-for haste, and to be content with partial instead of total extirpation of the growths. It is in these first few cases that the results obtained are apt to be unsatisfactory, and which must come, perhaps, a second time to the table.

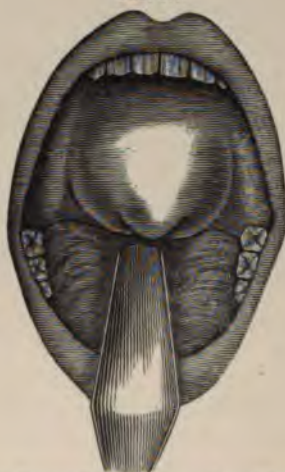
CHAPTER XI.

DISEASES OF THE UVULA.

ACUTE INFLAMMATION.

THIS commonly occurs in association with a tonsillitis or general faucitis, but there are times when the inflammatory action is almost strictly limited to the uvula. It is usually attributable to exposure and chilling in people of arthritic diathesis, and is analogous to a similar class of cases of tonsillitis. Owing to the

FIG. 67.



Acute inflammation of the uvula, with œdema.

loose, widely meshed arrangement of the cellular tissue in the uvula, the progress of the inflammation is usually rapid, and within a few hours such an amount of swelling and of œdema may be present that the patient may be threatened with suffocation.

Symptoms. These are such as would naturally attend the enlargement of this organ—the sense of fulness or of a foreign body in the faucial region, constant attempts at hawking or clearing the throat, perhaps retching, alteration of the voice, and indistinctness of articulation.

Diagnosis. Inspection will reveal in extreme cases an enormous œdematous enlargement of the uvula almost completely filling the faucial opening. All normal shape is lost, and the appearance is that of a translucent sac containing a thin serum. Such an appearance as this and the history of the very recent beginning and rapid progress of the attack will be enough to preclude any likelihood of mistaking the simple inflammation for an extensive gummatous infiltration of the structure. The mucous membrane of the entire soft palate is apt to be intensely hyperæmic, although the uvula itself is usually of a grayish or reddish-gray tint. It is not at all impossible that an almost identical picture may be presented by an acute angioneurotic œdema. The history, in this latter case, of previous attacks and the coexistence of other neurotic symptoms should lead one to a correct conclusion.

Treatment. The melting of pieces of ice within the mouth or the spraying of the swollen structure with antiseptic solutions, such as alum, 20 grains to the ounce of water, or glycerite of tannin, are palliative, and in the milder cases may prove sufficient to subdue the attack. In the more severe cases, however, where the infiltrative swelling is seemingly dangerous in its degree, the almost universal resource, until within the last several months, has been the bistoury. Multiple puncture or free scarification of the body has been practised, it having been previously cocainized, and this permits of the rapid escape of the effused fluid. This little operation is still just as efficient as ever, but it is seldom necessary now, because we have in the powdered extract of the suprarenal gland an agent that will reduce the swollen uvula with almost magical quickness.

A solution of this, made by adding 5 or 6 grains to a drachm of water, shaking for a few moments, and then filtering, if sprayed or painted upon the inflamed organ will be promptly followed by its contraction. This result may be hastened by placing 3 or 4 grains of the powder upon the tongue and directing it to be swallowed as it mingles with the saliva. If the œdema shows any tendency to recur the patient may use the powder in this latter way every two hours until the attack has entirely subsided. This remedy is equally as efficient in angioneurotic œdema as in that due to an ordinary inflammatory process.

HYPERTROPHY OR ELONGATION OF THE UVULA.

There are very few cases of chronic pharyngitis or nasopharyngitis that have not associated with them more or less chronic inflammation and hypertrophy of the uvula. There is no arbitrary length that can be assigned to this appendage of the soft palate, but during quiet respiration, with the mouth open and the tongue quite relaxed, the tip of the uvula should clear the base of

FIG. 68.



Elongation of the uvula.

the tongue by a third of an inch or more. It is seldom, if ever, that there is any increase of its muscular element, the hypertrophy commonly involving only the mucous and submucous tissues. This is made evident by the wrinkling of the mucous coating which occurs when the utterance of a high-pitched "ah!" raises and makes tense the velum and uvula.

Symptoms. The symptoms occasioned by this hypertrophy vary very greatly, being sometimes scarcely noticeable, while at others not only may the local disturbance be severe, but the general health may suffer as the result of secondary gastric derangement and interference with sleep resulting from the nocturnal cough. This latter is provoked by the irritation of the lower pharynx and perhaps the epiglottis by the pendulous uvula when the patient is recumbent. While these symptoms in varying degrees are common to all the subjects of uvular elongation, the professional voice user especially, and even more particularly the vocalist, will be seriously crippled by this condition. Fatigue will ensue upon even moderate use of the voice, and its purity and brilliancy will be greatly impaired.

In connection with the diagnosis we should differentiate as accurately as possible between the apparent lengthening of the uvula dependent upon palatal relaxation and that which is due to actual overgrowth. The determination of this point will decidedly influence the treatment.

Treatment. In all cases, even when there is no question as to the genuineness of the hypertrophy, some preliminary treatment of an astringent nature is highly desirable. A few repetitions of such applications as the glycerite of tannin, the combination of equal parts of tinc. ferri chlor. and glycerin, or perhaps an 8 per cent. solution of chloride of zinc, will at least lessen the superficial catarrhal congestion and render the throat less sensitive.

The subsequent removal of the redundant portion of the uvula will be rendered less disturbing by this preparation of the throat, and the pain and inflammatory reaction much restricted. It should be scarcely necessary to warn the student, the general practitioner, or the general surgeon that *complete* amputation of the uvula is very bad practice. Only the excess should be removed, and a uvula of normal length and physiological value should be permitted to remain. The operation may be performed with a pair of forceps and scissors of suitable length, or one of the

several forms of uvulatore may be employed. The one devised by Seiler (Fig. 69) is perfectly satisfactory, and a little practice in its use will lead to its almost invariable adoption. The first step in the operation is to spray the faucial region as a whole with a 2 per cent. solution of cocaine, and then, with the cotton-carrier, to apply to the uvula itself a 4 per cent. solution. At the end of three or four minutes the base of the tongue is well depressed with the spatula, the uvulatore introduced, its blades opened, and the tip of the uvula allowed to drop within them. The proper length of the body is carefully measured with the eye, and the blades then instantly closed. The transverse arm at the extremity of one of the blades not only prevents the uvula from slipping from between them, but it enables the operator to draw it

FIG. 69.



Seiler's uvulatore.

slightly toward him, so that when the cut is made the wound will be upon its posterior face. It is thus protected from frequent irritation through contact with the food. This, by the way, should be, during the period of cicatrization, soft, of moderate temperature, and very slightly seasoned. Hemorrhage is a very exceptional feature of this operation, but if it should prove a little more free or persistent than usual a slight touch with the galvanocautery will close the vessels, or, in lieu of this, 3 or 4 grains of the powdered suprarenal gland placed dry upon the tongue will rarely fail to arrest the flow.

DISEASES OF THE FAUCIAL TONSILS.

A study of the structure of these glands will add very much to the completeness and clearness of our understanding of their

diseases. In childhood they are usually quite prominent, but it is customary for them to become less so as youth advances, and after the age of sixteen years the normal tonsil has either almost disappeared or at least does not project beyond the level of the faucial pillars. We may be pretty confident that they have no physiological value after this age, and that, so far from being essential to the health of the individual, they are apt to become not only themselves the frequent seat of disease, but avenues for general infection as well.

ACUTE LACUNAR TONSILLITIS.

Certain predisposing causes for this disease are found in an abnormal size and a chronic lacunar catarrh of the gland, in the lowered vitality and enfeebled tissue resistance of struma, and in the rheumatic or gouty diathesis. The influence of this latter factor is shown particularly in children by the fact that it is in those who suffer from frequent attacks of urticaria and "growing pains" that lacunar tonsillitis is most easily and often excited. One or more of these in association with an exciting cause, such as an acute attack of indigestion or exposure to a draught or prolonged cold, particularly when fatigued, will be usually quite sufficient to bring about an acute tonsillar inflammation. This may attack different portions of the gland with varying degrees of violence, at one time it being the mucous covering and the crypts that show the greatest disturbance; while at another it is the cortical portion—the parenchyma of the gland—that suffers the most. Though there is some slight pathological difference between these, yet clinically they are closely similar, and the same therapeutic measures are of equal value in both, so that we need scarcely describe them separately.

Pathology. The pathology of the disease acquires some special interest from a bacteriological point of view. The association of one or several varieties of micro-organisms with tonsillar inflam-

mation is almost constant, but investigation has not yet shown that any one of them is essential to its development or is capable of conveying it to another individual or of reproducing it in animals.

The streptococci and the staphylococci are those most frequently and numerous in evidence, but we may also find a form of pneumococcus, and, though rarely, the Klebs-Löffler bacillus, or even that of Koch.

Symptoms. The symptoms in any but the mildest cases are usually sufficiently characteristic to permit a diagnosis to be made even previous to inspection of the throat. The expression of pain upon and the flushing of the patient's face, his altered voice and indistinctness of articulation, the frequent but cautious clearing of the throat, and the expectoration of the mucus and saliva because of his desire to avoid the pain of swallowing, and finally the suspension of nasal breathing, necessitating the half-open mouth—all these should easily lead one to a correct opinion as to the nature of the disease. Any lingering doubt, however, is quickly removed by a glance at the throat, and here the bright crimson of the tonsils and half arches, of the velum and pharyngeal walls, the swelling of the tonsils, and the distention of the lacunæ with masses of a yellowish-white cheesy material—made up of epithelial cells, leucocytes, cocci, and perhaps some fibrin—are the chief objective features. The appearance of these plugs of arrested secretion at the mouths of the crypts often gives rise to that diagnostic absurdity, "ulcerated sore-throat." There is no ulceration, and even if there were, this would be a very slovenly and inaccurate way of referring to it. There may be some swelling and tenderness of the lymphatic glands of the neck, but if present at all it is usually very slight. The general systemic disturbance is commonly quite marked. The temperature fluctuates between 102° and 105°, the tongue is coated and the breath foul, and there is frequently considerable headache and general muscular aching.

Diagnosis. The diagnosis is not always easy, and, of course, our chief concern will be to distinguish it as promptly as possible from diphtheria. At first sight we may be rather puzzled by the resemblance, but closer scrutiny will show that although the lacunar plugs may have extended somewhat around the margins of the crypts, and perhaps coalesced with adjoining ones, yet that the suspicious-looking material is not a membrane, and that it may be brushed off or otherwise removed without causing bleeding or uncovering any breach of tissue. It shows no disposition to extend upward upon the faucial pillars to the velum and uvula or posteriorly to the pharynx. The coloring of the inflamed mucous membrane is also different in the two diseases, that of acute tonsillitis being brighter and more energetic in its appearance than that of diphtheria. The temperature-range in the latter disease is much lower, while the involvement of the neighboring lymphatics is much greater. A few hours are usually sufficient to make the diagnosis positive, but during this time the patient should be isolated as carefully as though we knew it to be a case of diphtheria. The evidence afforded by the examination of the urine and culture tests of the exudate will of course be included in our study of the case.

The tonsillitis accompanying the exanthemata, particularly scarlet fever, is of this lacunar type, but the participation of micro-organisms is usually much more marked, the streptococci being especially numerous and active.

Prognosis. An uncomplicated attack of acute lacunar tonsillitis invariably ends in recovery.

Treatment. Whatever the cause of the inflammation may have been, the first measure employed to check it should be the thorough evacuation of the intestines. In children the effervescent citrate of magnesia alone, and in adults calomel or blue mass, followed by the salines, are perfectly satisfactory. With an eye to the existence of the rheumatic diathesis, which, indeed, is certainly present in the majority of adult cases, we may give, imme-

diately upon the movement of the bowels, a capsule containing 3 grains each of salol or salicylate of soda, phenacetine, and Dover's powder. The greater the activity of the rheumatic or gouty factor the greater will be the relief afforded by this or some similar combination. Given at first every hour, it may be reduced in frequency as the pain and systemic disturbance subside. When the rheumatic element is but slightly in evidence the following formula may be used in preference to the salicylate treatment :

R.	Tinct. ferri chlor.		f 3 ij.
	Potass. chlorat.,		
	Potass. bromid.	aa	3 ij.
	Ext. glycyrrhizæ		3 j.
	Aquæ	q. s. ft.	f 3 vj.—M.

S. Two teaspoonfuls in water. Gargle and swallow every two or three hours.

The diet should, of course, be almost limited to milk.

The local treatment varies somewhat with the stage of the disease. If it should be seen in that of invasion the application to the tonsils of a 40 or 60-grain solution of silver nitrate is quite often successful in arresting the progress of the inflammation. Guaiacol, pure or in 50 per cent. glycerin solution, is similarly effective, especially in the clearly rheumatic patient. With the exception noted above gargles should be discarded, and in their place some form of astringent and mildly antiseptic lozenge employed. These may contain chlorate of potash, alum, borax, iron, etc. Unless the degree of constitutional involvement is very slight it will be quite worth while to keep the patient in bed. The discomfort and indeed suffering of the patient will be very materially diminished if, throughout the attack, the nose and nasopharynx are cleansed every few hours with the Dobell solution.

CHRONIC LACUNAR TONSILLITIS.

In varying degrees of severity this is an extremely prevalent affection. It gradually develops as the result of a series of acute

inflammations of the tonsil, and is encouraged by the same constitutional failings that predispose to the acute attacks. In very frequent association with it we will find more or less gastro-intestinal catarrh. It is not an essential condition of the disease that the tonsils be abnormally large. Even in the contracted fibroid tonsil of adults we very often encounter it.

Symptoms. The symptoms are not at all aggressive as a rule and the patient himself may for a long time be quite unaware of his tonsillar condition. If it is not the annoyingly frequent attacks of acute inflammation that induce him to seek relief it will usually be the daily expulsion into the mouth of one or more of the lacunar plugs. The nauseating, rotten taste and odor of these yellowish-white masses are more than a person of even less than ordinary sensibility can endure. When there are several diseased crypts the breath is almost certain to be extremely offensive, and it is not at all unusual for the appetite to be impaired and digestion disturbed. In certain cases one or more of the crypts, owing to narrowing of their mouths, become distended to such an extent that considerable pain and inflammation are excited, and continue until the irritating mass makes its escape. If the orifices of these particular crypts happen to be concealed behind the anterior faucial pillars, or should they open into the supratonsillar fossa, or along the posterior border of the gland, they may and often do entirely escape detection by the ordinary methods of examination. The faucial pillars should therefore be drawn aside by a blunt hook, the supratonsillar fossa exposed by some similar manœuvre, or by making the patient gag, and finally the posterior border of the gland examined by means of one of the smaller laryngeal mirrors.

Treatment. The removal of the tonsil would of course be the most radical and expeditious means of cure, but this is not always practicable, even should there be no objection from the patient. In lieu of this, therefore, our endeavor will be to thoroughly empty and cleanse each diseased lacuna and to restore it to its normal

calibre. While we are gradually accomplishing this we should at the same time treat with equal activity the nasopharyngeal and the gastro-intestinal catarrh that almost invariably coexist and do much to perpetuate the tonsillar disease. Various instruments are employed for the purpose of emptying the crypts. A number of spoons, hooks, and curettes have been devised, and there is no occasion for devising any more. The one that I have used for a number of years with entire satisfaction is the blunt ring ear-curette of Buck. This can be dipped down to the very bottom of the different lacunæ and the accumulated secretion lifted out with but little difficulty. This done, a wisp of cotton should be wrapped around the applicator, moistened with one of the iodine solutions (page 115), and then introduced within the empty crypt and applied to its walls with some little friction. A few repetitions of this treatment will check the too rapid epithelial desquamation and the exudation of lymphoid cells, will stimulate the relaxed tissues to contraction and prevent any refilling of the crypts. In obstinate cases success may at times only be gained through the obliteration of one or more of the dilated lacunæ. This is best accomplished by means of chromic acid fused upon the applicator or by a suitable electrode connected with a galvanocautery battery.

In order that the treatment of this disease may not be prolonged indefinitely and the patience of both physician and patient exhausted, it will be necessary to make the preliminary examination of the tonsil absolutely thorough. Every portion of the gland should be searched, every furrow and fold carefully explored for the hidden mouths of any lacunæ. It is only by thoroughness of cleansing and local medication that we can hope to conquer within a reasonably short time this very persistent disease.

ACUTE PERITONSILLITIS.**Quinsy—Peritonsillar Abscess.**

We may gather from its title both the site of this disease and the tissue that is involved in the inflammation. Although there may be more or less vascular disturbance within the tonsil itself, yet the intensity of the inflammatory process is expended upon the cellular tissue external to and above it. Infection may and probably often does occur through the medium of the tonsillar lymphatics, but whether it reaches the cellular tissue by this route, or whether it is carried thither by the bloodvessels, the primary seat of the inflammation is certainly external to and not within the tonsil. Probably the gouty or rheumatic diathesis is as strongly predisposing to this affection as to the strictly tonsillar inflammations, perhaps even more so; but an additional and very active contributing factor to the occurrence of this disease is a state of lowered general vitality, one effect of which is an enfeebled tissue resistance. It is in those who have been overworked, or who have suffered from some prolonged anxiety or other nervous strain, or who have been indulging to excess in some form of dissipation, that a peritonsillitis is most apt to occur upon exposure to an exciting cause. In the larger number of cases this latter is the chill that follows exhaustion of the available heat within the body as the result of exposure to dampness or cold. No doubt bacterial infection plays a frequent and prominent part in the production of this inflammation, and it is in these cases particularly that the process is apt to terminate in suppuration and abscess formation.

Symptoms. Those who have had a single personal experience with this disease, or who have had the opportunity of observing an attack in someone else, will need no description of its symptoms. The suffering, indeed, the agony of the patient, extending perhaps over several days, will make an indelible impression upon

the memory. There is always a preliminary chill, often severe enough to be termed a rigor, followed by febrile disturbance of varying degree and a sense of profound malaise. The local symptoms are early in their appearance, one side of the throat becoming uneasy, stiffened, and the seat of a dull ache. The pain rapidly increases in intensity, swallowing becomes almost unendurable, and the saliva, secreted in great excess, is allowed to flow from the mouth. The lower jaw is at times almost immobilized, and it may be so tightly closed that we cannot obtain a satisfactory view of the inflamed structures. The voice is thick and guttural, at times almost suppressed, and there is no attempt at articulation. Groans are about the only sounds that come from the patient. The tongue quickly acquires a thick, pasty coating, and the breath becomes extremely offensive. Anorexia is complete and constipation the rule. During the first day or two of the attack inspection shows the half arches of one side to be reddened and swollen and a deep and rapidly increasing flush upon the lateral half of the soft palate. Bulging of this above and external to the tonsils occurs, and the tonsil is pushed inward and perhaps beyond the middle line of the fauces. The gland itself, however, although reddened, is not necessarily swollen to any extent, and a moment's scrutiny will show that it is not the centre of disturbance.

Pathology. The pathology is that of inflammation occurring in any other cellular tissue.

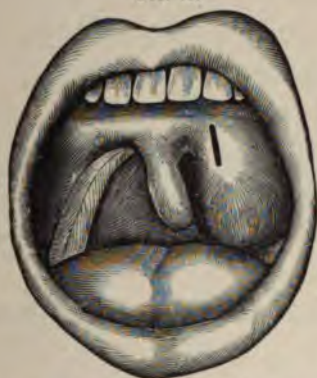
Diagnosis. The diagnosis can scarcely present any difficulty. The examination of the throat, the history of the attack, and the statement, usually forthcoming, that it has been preceded by one or several similar attacks, are quite sufficient, as a rule, to assure us of its nature.

Prognosis. The prognosis, in the absence of any complicating circumstances, is entirely favorable.

Treatment. If the patient is seen within the first twenty-four or thirty-six hours of the attack it is quite worth while making

the attempt to prevent the advance of the inflammation to the point of suppuration. If the patient can be prevailed upon to remain in bed so much the better. Free purgation is obtained, and then generous doses of the salicylates, in combination, perhaps, with phenacetine and Dover's powder, are administered as in acute lacunar tonsillitis. One drop of the tincture of aconite, given every half-hour, will be of additional value. As for local treatment, the external application of cold by means of ice-bags or the Leiter coil is very often entirely successful in arresting the disease. The only direct application to the tonsillar region that

FIG. 70.



Peritonsillar abscess on the left side. (COAKLEY.)

is of real and decided value is guaiacol combined with an equal quantity of glycerin or almond oil. This, repeated two or three times in the twenty-four hours, will often prove surprisingly effective. The Dobell solution should be frequently sprayed into the nose, in order that both it and the nasopharynx may be kept free from mucus. If it is evident, however, that it is too late for us to avoid suppuration we should do all that we can to hasten it. Heat in the form of poultices should be substituted for the ice-bags, and the mouth may be frequently rinsed with hot water if pain prohibits its use as a gargle. The point at which we will most frequently discover the approach of pus to

the surface is about half an inch external to the base of the uvula. (Fig. 70.) The moment that pus can be discovered by the eye or softening be detected by the fingers a 6 or 8 per cent. solution of cocaine should be brushed over the mucous membrane and a sufficiently deep and free incision made to permit of the emptying of the abscess. The pus is apt to be rather thicker than in an ordinary abscess, and, therefore, a mere puncture will be of very little value. As a matter of prudence the knife should be introduced with its cutting edge turned inward, but there is really very little danger of wounding the large vessels, since they are pushed so far outward and backward by the collection of pus as to be quite out of harm's way. When emptied the abscess cavity may be syringed with an antiseptic solution and the poultices and hot-water gargling continued for a few hours. Convalescence is, as a rule, wonderfully prompt.

With the termination of the attack prophylaxis should be furthered by the removal of tonsils that are at all hypertrophied or that show any evidence of chronic lacunar catarrh.

HYPERTROPHY OF THE TONSILS.

This may be found in infants as a congenital abnormality, and in children and in adults as the result of chronic inflammatory change induced by repeated attacks of acute inflammation. At different ages and under varying diathetic conditions the particular portion of the glandular structure that is chiefly involved in the overgrowth may vary, but it is of no practical advantage to give a fictitious importance to this variation by indulging in classifications. A very simple distinction is that which is based upon the density of the enlarged gland, it being in children quite soft, because of the lymphoid or cellular nature of the hyperplasia, while in adults it is much more resistant because of the presence of a larger proportion of fibrous tissue.

Symptoms. The symptoms occasioned by tonsillar hypertrophy affect the character of the voice, the ease of deglutition, the res-

piration—mouth being substituted for nasal breathing, the integrity of the special senses of smell, taste, and hearing, and, finally, mental activity as well as the general health. Examination of the enlarged glands will reveal their size, their vascularity, and the presence or absence of lacunar catarrh. The use of the probe, or, better, the finger, will disclose their degree of hardness and give us a hint as to the best method of treatment.

Treatment. The choice of treatment lies between the gradual reduction of the hypertrophied tonsil by means of electrolysis, the galvanocautery, or the tonsillar punch, and its immediate removal by the tonsillotome, the hot or cold-wire snare, or the knife. Let us clearly understand one thing at the outset—that a chronically diseased or enlarged tonsil is not only of no physiological value, but that it is both objectionable in itself and a menace to the

FIG. 71.



Mathieu's tonsillotome.

safety of its possessor should he be exposed to almost any of the infectious diseases. The superstitions concerning certain injurious results that have been said to ensue upon tonsillotomy are almost beneath notice. It is only because there are still a few people ignorant enough to oppose the operation on the ground that it may occasion loss of the voice, increased liability to colds, or arrest of sexual development that we should be prepared to show the absurdity of such contentions. Nothing but benefit can follow the removal of diseased tonsils, while much that is serious and even dangerous may proceed from their retention. In children their removal is so easily, safely, and satisfactorily accomplished by means of the Mathieu tonsillotome that we need scarcely consider any other method. The glands may be enormously large—actually in contact, perhaps, with one another—

but they are invariably soft and only slightly vascular, and the operation possesses no danger and only such difficulties as may proceed from the child's resistance. These latter may be minimized by patience and tact on the part of the operator. The child need not know just what is to be done. If the operator has any gentleness of manner and touch he can usually cocaineize the borders of the tonsil with a 4 per cent. solution without encountering any opposition; and, this having been done, it is simply a matter of quickness and dexterity to slip the tonsillotome back into the throat, to encircle with it the enlarged gland, and, pressing this inward by the free hand below the angle of the jaw, to cut it off as close to its base as possible. (Fig. 72.) Skill and

FIG. 72.



Removal of tonsil with tonsillotome.

speed will come with practice, and they will come so much the sooner if the student will dismiss from his mind any dread of inflicting injury upon the patient. One of the greatest virtues of the Mathieu instrument is the almost absolute protection that it affords the patient against injury that might otherwise result from awkwardness or carelessness upon the part of the operator. It is not at all infrequent for the anterior facial pillar to be adherent to the enlarged gland and to cover quite a large portion of it. When this condition is present it is a necessary preliminary to the operation that the adhesions be divided, the pillar pushed aside, and the tonsil thoroughly exposed. If both tonsils are to be excised it is better to make one operation of it as as

have but one sore throat; but if the child is not only unwilling to have the second removed, but is uncontrollable, we may be compelled to wait a few days before completing the operation, and then to call to our aid nitrous oxide gas or ether. Hemorrhage, though it may be brisk for a few moments, is of very brief duration. For the two or three days succeeding the operation the throat may be rather painful, and the diet should be restricted to soft and unirritating articles of food, which should be given cool or only slightly warmed.

In removing the fibroid tonsil of the adult it may be as well to recognize the possibility of severe hemorrhage, however remote that possibility may be. My own experience has not as yet afforded me an instance of it; indeed, I have never even had occasion to resort to anything of a styptic nature. Nevertheless, if there should be any reason to suspect the existence of a hemorrhagic tendency we may use the snare instead of the guillotine, or, if the tonsil is not of any great size, we may remove it piecemeal by means of the tonsil punch. The reduction of this type of tonsil by the method of repeated galvanocauterization is very tedious and very painful, and is altogether objectionable.

MYCOSIS TONSILLARIS.

Although comparatively infrequent, this is a disease that the general practitioner should be prepared to recognize. It is characterized by the growth in the fauces of one or more of the several varieties of *leptothrix*. This is seldom limited to the faucial tonsils, but is usually equally luxuriant upon the base of the tongue and the lateral and posterior walls of the oropharynx. When abundant—and it has usually become so before it attracts the patient's notice—the appearance of the throat is quite unique. It is thickly studded with minute white rods or tufts, which project some little distance above the surface of the membrane. They are usually discrete, though at times quite closely grouped. They grow from the lacunæ of the faucial and lingual tonsils and

from the lymphoid follicles distributed so plentifully throughout the pharyngeal mucous membrane.

Etiology. Little that is definite is known concerning the etiology of this disease. Nothing of a diathetic nature seems to favor its occurrence; indeed, many of those who have it quite well developed are in most excellent general health. Local conditions which are usually coexistent are chronic lacunar catarrh of the tonsils and chronic follicular pharyngitis; but what the relation is, if any, between the catarrh and the growth of the fungus has not as yet been traced. At one time the microscope will show the filaments grouped in bundles, and at another scattered without any appearance of arrangement, among epithelial cells, cocci, and granular *débris*.

Symptoms. That the symptoms occasioned by this disease are scarcely noticeable is evidenced by the fact that it may exist for a very long time without the patient being at all aware of it. It is often discovered purely by accident, and it is not unlikely that a number of cases occur and get well of themselves without ever being recognized, so that we are quite in the dark as to the actual frequency of the disease. The throat may be a little irritable or oversensitive, or the patient may be conscious at times of a tickling or scratching sensation, as though from the presence of a foreign body. Beyond this, however, there is seldom anything worth mentioning unless it be that throats within which this fungus is growing seem somewhat more liable to attacks of acute catarrhal inflammation.

Treatment. Treatment is rather unsatisfactory, because we know of nothing that has a specifically antagonistic effect upon the leptothrix. The effort to free the throat from it is always a prolonged one, and very often the patient will discontinue his visits before success is even in sight. The method that I have found to be most commonly and quickly effective is to first cocaine with the applicator the faucial mucous membrane, and then, with a Buck's sharp ear curette, to go over the entire area

upon which the fungus is implanted. Every little rod and tuft and patch of the growth is scraped away as completely as possible, and then the points from which they have grown touched and pretty firmly rubbed with an applicator the cotton tip of which is wet with the pure tincture of the chloride of iron. The success of this or of any other of the many remedies that have been suggested depends entirely upon the perseverance and thoroughness with which it is applied to the diseased membrane. Even with the greatest care, however, the cure of a well-developed case in less than six weeks or two months will be a credit to the practitioner. The galvanocautery is not a bit better than several other remedies that are less heroic as well as less offensive to the patient, and I do not advocate it.

NEOPLASMS OF THE FAUCIAL TONSILS.

Those of a benign nature belong almost without exception to one of these four varieties—lymphomata, fibromata, papillomata, or angiomata. Ordinary surgical principles apply to their treatment.

Malignant growths, in the light of recent investigation, may be classified under epitheliomata and sarcomata, the first of these including the squamous, alveolar, and columnar types, while the latter comprise the round and the spindle-shaped varieties and the lymphosarcomata and angiosarcomata.

With reference to these cancerous affections of the tonsils I shall only call attention to the diagnostic points between them and syphilitic diseases of the glands. In the absence of a reliable and sufficient history for the purposes of diagnosis we may note that the ulcerative manifestations of late syphilis are attended with very little if any pain, and that the act of swallowing is never interfered with by any degree of suffering. The sympathetic glandular enlargement is usually trivial, and there is no tenderness worth mentioning. Hemorrhage is extremely rare, and the general nutrition is seldom noticeably impaired. In

cancer, however, severe pain is constantly present, and is so intensified by efforts at deglutition that this act becomes impossible. As a consequence, serious loss of flesh is rather an early symptom. Moreover, examination of the throat reveals an unmistakable new-growth, although this may have undergone extensive destruction by ulceration. The neighboring lymphatic glands are invariably infiltrated and indurated, and are usually but little less painful than the diseased tissue itself. Hemorrhage is apt to be frequent and profuse. Finally, suitable treatment will quickly control a syphilitic process, while one that is cancerous will defy the most judicious and energetic measures.

THE LINGUAL TONSIL.

It is very seldom that the little collection of adenoid tissue at the base of the tongue that has been dignified with the name of the lingual tonsil will demand any special attention as the result of disease. It is subject in very minor degree to the same diseases that affect the faucial and pharyngeal tonsils, and it is usually involved in conjunction with them, but so slightly, as a rule, that it does not require that treatment should be addressed directly to it. If enlarged it should be reduced by applications of tinct. ferri chlor., a 30-grain solution of zinc chloride, or cauterization with chromic acid. If these fail its removal may be effected by the cold snare or by a specially devised tonsillotome.

Quite an obstinate and abundant hæmoptysis may now and then be occasioned by a varicose condition of the veins at the base of the tongue. In the laryngeal mirror they can be seen dilated and tortuous, and at times the leakage of blood may be detected. The touching of these a few times with the pure tincture of iron usually results in their contraction, but should they persist the galvanocautery is here admirable and infallible.

CHAPTER XII.

DISEASES OF THE PHARYNX.

ACUTE CATARRHAL PHARYNGITIS.

ALTHOUGH comparatively infrequent, there are times when inflammation is almost strictly limited to the pharynx. As a rule, however, there is associated with it similar disturbance of the nasopharynx and the faucial region. There is quite a large number of conditions which predispose the pharynx to this simple acute inflammation, but, instead of giving a list of them, we may epitomize the matter by stating that whatever contributes to the development and maintenance of a chronic irritative hyperæmia of the pharyngeal mucous membrane will thereby do much to increase its liability to acute inflammatory disturbance. Chronic gastro-intestinal catarrh, with its attendant constipation and auto-intoxication; occupations which involve exposure to irritating dusts or gases; sufficient nasal obstruction to compel mouth-breathing; certain diathetic states, particularly those of gout and rheumatism; and, finally, the intemperate use of alcohol or tobacco—these are some of the more prominent predisposing causes of acute pharyngitis. The exciting causes are the same as those which provoke inflammation in the adjoining cavities.

Symptoms. There is no occasion for describing separately the several varieties of acute pharyngitis. The simple, the infectious, the rheumatic, the membranous are all closely similar to one another in their general features; and though there are certain pathological points of distinction, their general course is largely the same. The earliest symptom is usually a sensation of dryness or stiffness of the throat, and this becomes not only the

more noticeable upon swallowing, but there may be added to it more or less pain, which increases until the attack reaches its height. The voice is not necessarily husky, nor is it at all enfeebled, but there is a distinct alteration in its quality. Cough, if present, is of rather mild character, and is dry and irritative without being painful. With the progress of the disease the early dryness of the mucous membrane is supplanted by a re-establishment of secretion, this at first being thick and scanty, but later more fluid and abundant, and perhaps mucopurulent. Inspection during the stage of invasion of the simple variety of inflammation discovers an evenly diffused bright redness of the mucous membrane, which is dry and of glazed appearance and is evidently somewhat swollen by the vascular engorgement and submucous infiltration. The rheumatic type of the disease is usually marked by a special involvement of the lateral walls of the pharynx, often leading to the term *pharyngitis lateralis*, by intensified redness in this situation and by an extraordinary amount of pain. The violent pain of this form of the disease quite often precedes by a day or two the appearance of the inflammation upon the surface. Membranous pharyngitis is, of course, characterized by the exudate, which may be either of a simple croupous nature or diphtheritic. In the former the streptococcus is not infrequently found in some abundance, but its presence is probably incidental to rather than causative of the disease.

Pathology. The pathology differs in no important particular from that of inflammation of the mucous membranes in other situations. With the exception of the diphtheritic form of pharyngitis, the others, if uncomplicated, are of uniformly favorable prognosis.

Treatment. The general treatment is usually clearly indicated by the character of the inflammation. In any of the types moderate catharsis is an excellent preliminary to all other treatment. Following this the simple sthenic variety will be moderated by a vascular depressant like aconite or gelsemium; the

rheumatic by the salicylates, with the addition, perhaps, of an anodyne to control the intense pain; the septic or infectious by those remedies—quinine, iron, strychnine, etc.—that counteract the effects of toxæmia. Local treatment may vary somewhat with the violence of the inflammation, but the frequent and thorough cleansing of the nose and nasopharynx, as well as the pharynx itself, by the alkaline spray is of first importance. After all mucus has been removed from the pharynx by this solvent spray the very gentle mopping of the surface with a silver nitrate solution of from 30 to 60 grains to the ounce will lessen the vascular engorgement and give much relief to the patient. It may be used twice daily. Gargles have already been condemned, and in their stead the lozenge or throat pastille will be found very satisfactory. An astringent sedative combination made up with licorice or gelatin will favorably affect both the duration and discomfort of the attack. Cocaine, chlorate and bromide of potash, tincture of iron, muriate of ammonia, rhatany, alum, and many other similar remedies may serve as ingredients of the lozenge. From the commencement of the disease until convalescence is well advanced the diet should be as bland and unirritating as possible. Nothing requiring mastication should be allowed, and everything in the way of piquant seasoning prohibited. As a matter of course, smoking and drinking must be suspended, and the less the voice is used the less will be the danger of extension of the inflammation to the larynx.

CHRONIC PHARYNGITIS.

Granular, Follicular, or Herpetic Pharyngitis; Clergyman's Sore-throat. Atrophic Pharyngitis, Pharyngitis Sicca

All the above names are employed to designate at different stages, or according to the predominance of certain pathological features, one and the same disease. For practical purposes we may ignore the hair-splitting distinctions that the several qualify-

ing adjectives indicate, and assume that the term chronic pharyngitis will cover them all.

The chronic catarrhal process may gradually develop as the result of a number of acute attacks, each of which has left its imprint upon the mucous membrane in the shape of a certain degree of persistent vascular dilatation. Diathetic influences are also to be frequently reckoned with in studying the causation of the disease, and other etiological factors are to be found in the patient's occupation, his vices, and all matters that may be included under the term personal hygiene. Chronic nasal or nasopharyngeal disease, with perhaps the accompanying necessity for mouth-breathing, will inevitably lead to secondary disturbance of the pharynx.

A final cause which is very commonly in evidence is some fault connected with the production and use of the voice. It is the pathogenic activity of this vocal misuse that has given birth to the terms "clergyman's or voice user's sore-throat."

Symptoms. The symptoms vary in urgency with the duration of the disease and the kind and extent of the pathological alterations. The patient is always conscious of his throat. It is very seldom actually painful, but there is an ever-present sense of discomfort or uneasiness. The adherent viscid mucus of the earlier and the abnormal dryness of the membrane of the later stages alike suggest the presence of a foreign body, and occasion the slight cough or the frequent attempts at swallowing or clearing the throat. These symptoms are accentuated when the follicular or glandular hypertrophies are present which are indicated in the title "granular or follicular pharyngitis." (Fig. 73.) The quality of the voice is invariably altered, and not only the quality, but the steadiness and smoothness of it. The vocalist loses his accuracy of intonation, and is liable to sing "off key." The professional voice user is heavily handicapped by a chronic pharyngitis, both talking and singing quickly inducing fatigue and aching of the throat, and the compass of the voice being curtailed at both ends.

The physical changes in the appearance of the mucous membrane include alterations of its color, secretion, and form. The color is not the vivid crimson of acute inflammation, but is the more sombre tint of venous engorgement. It is seldom uniform, however, and the pharynx usually presents a mottled appearance. A number of dilated veins are commonly seen upon its surface, and patches of capillary congestion of varying size are also a frequent occurrence.

The character and quantity of the secretion vary with the stage of the disease, being at first mucoid and abundant, later viscid and scanty, and, finally, as a consequence of glandular atrophy, absent.

FIG. 78.



Granular pharyngitis.

The changes in form are occasioned by the thickening of the lateral walls, the enlargement of the glands and the groups of follicles in the membrane of the posterior wall, and, in the advanced stages, by areas of atrophy of the submucous tissue.

Pathology. The pathology has been sufficiently indicated by what has been said under the etiology and symptomatology of the disease.

Diagnosis. The diagnosis presents no difficulty, and the character of the *prognosis* depends largely upon the age and general condition of the patient and upon the fidelity with which he observes our instructions.

Treatment. The value of an intimate knowledge of general medicine will display itself in the treatment of this disease. To be successful we must give the general treatment equal or greater prominence than the local. Every remote cause that can contribute to the maintenance of the pharyngeal disturbance must, if possible, be removed. Whether this be gastro-intestinal, hepatic, cardiac, or renal, or of a diathetic nature, it is equally important that it shall receive our special study and care. It is a mere formality to state that anything having a directly irritating effect upon the catarrhal mucous membrane must be restricted or prohibited. Alcohol and tobacco not only have this effect, but their immoderate use disturbs as well the digestive processes, and consequently impairs general nutrition. The professional voice user who knows little of proper breath control and less of correct tone-production must become proficient in both if he would hope for permanent cure of his chronic pharyngitis. It is again merely perfunctory to remind the reader that any nasal or nasopharyngeal abnormality must be corrected before we can make any impression upon the pharyngeal disease.

As to local treatment, it will vary somewhat with the special features of each case, but it is always to be remembered that morning and evening cleansing of the nasal and postnasal cavities must be faithfully carried out by the patient. At different periods of the disease, or with its different types, the physician's choice of topical remedies will lie between sedatives, astringents, stimulants, or caustics, and, in addition to these, he may at times find it necessary to resort to instrumental aid. In the simple catarrhal case gentle mopping of the membrane two or three times each week with a 20 or 30-grain solution of silver nitrate, or one of zinc chloride, 20 grains, will be found efficient, the frequency and strength of the application being reduced as improvement becomes manifest. A solution of alum, 10 grains, with carbolic acid, 1 grain to the ounce, makes an excellent spray for domestic use in these cases. This is not to be used in the nose. An

astringent lozenge is also a valuable therapeutical adjuvant, and of these there is a long list from which to choose.

Where there is a gouty or rheumatic dyscrasia in evidence the local treatment may be much the same as the foregoing, but systemic measures of a distinctly antilithic nature should be pushed.

Where the throat is of the granular or chronic follicular class we may employ with advantage the iodine and iodide of potash solution; but if, after a few weeks' use of this, the follicular hypertrophies show little disposition to shrink and disappear, we may touch them, after cocainization, with a chromic-acid crystal or the galvanocautery point. When they are particularly large and persistent it is a radical cure to make a crucial incision in each and then to empty and scrape them thoroughly with a sharp curette.

RETROPHARYNGEAL ABSCESS.

This affection is the outcome of a suppurative inflammation involving the glandular and cellular tissue of the retropharyngeal space. It is an extremely infrequent disease. It may, perhaps, occur more often than statistics indicate, because there are times when it is by no means easy of diagnosis, and such cases, terminating spontaneously and favorably, are apt to escape recognition and record. This diagnostic shortcoming is, no doubt, largely due to the fact that the disease is almost exclusively one of infancy and early childhood, and at this age examination, to be satisfactory and conclusive in its results, requires more expertness than is possessed by the average general practitioner. Its rarity in adults is evidenced by the fact that fewer than a dozen cases have been recorded by competent observers. In children the majority of cases occur between the ages of two and five years.

Etiology. The etiology of the disease is somewhat obscure. Excluding the cases that have evidently ensued upon traumatism, we are often unable to indicate with any certainty the exciting cause. As to the predisposing causes, we are pretty well

assured that struma, rickets, tuberculosis, and inherited syphilis may be numbered among these; but in no case has it been possible to regard these conditions as more than contributory. From the fact that abscess in this situation has been more often the sequel of one of the exanthemata, or diphtheria, or some other infective inflammation of the nasal and faucial mucous membranes, we are apparently justified in concluding that the disease is usually of bacterial origin. Whether the route of infection, however, is direct or indirect—whether, in other words, the pyogenic organism penetrates the overlying mucous membrane or is carried to the retropharyngeal space through the lymph channels—we cannot be positive. In a small proportion of cases the disease occurs as a complication of spinal caries (Pott's disease).

Pathology. Previous to the fifth year of life a small group of lymph glands is commonly found beneath the pharyngeal mucous membrane in the vicinity of the third cervical vertebra. It is to these glands that the infective principle probably makes its way, and they are, no doubt, the starting-point of the suppurative process. Once begun this may extend upward or downward, and if it elects the latter course the pus may burrow its way to or below the inferior limit of the laryngopharynx. The micro-organism responsible for the abscess formation is one form or another of the streptococcus.

Symptomatology. There is nothing very distinctive about the symptoms during the first few days of the disease. The child is fretful and restless and seems disinclined to move the head as freely as usual. It may be held backward or to one or the other side in an effort to relieve tension and pain. With the increase of its contents and the encroachment of the abscess upon the lumen of the pharynx, there will be a more or less characteristic alteration of the voice. It is not suppressed, as in croup or acute catarrhal laryngitis, but the change is simply one of quality, and has been likened by an imaginative Frenchman to the cry of the duck. Simultaneously, both pain and difficulty of deglutition

will become apparent, and the child will refuse breast or bottle and cry from hunger rather than endure the pain of swallowing.

Any significant amount of dyspnœa is not apt to be an associated symptom unless the tumor is of unusual dimensions or is so situated as to overlie or to exert pressure upon the larynx itself. In case this happens the symptom-complex will be similar in many respects to that of croupous obstruction of the larynx. Even without treatment the postponement of spontaneous rupture of the abscess will scarcely be long enough to permit any noticeable amount of emaciation. The child's face may become a trifle pinched, perhaps, but seldom more than this.

Diagnosis. When the more prominent symptoms have become so marked as to compel examination of the throat, something of the following condition will be disclosed: the tumor will be found projecting directly forward from the middle line of the pharynx, or at times it will be directed inward and forward from the lateral wall. In extreme cases the uvula and soft palate will be lifted and advanced by the swelling, so that not only is the faucial opening filled by it, but the oral cavity itself is encroached upon. The color of the tumor is usually strongly suggestive of its contents, and if gentle digital examination be resorted to the fluctuation and entire absence of pulsation that will be discovered by it will supply us with all the additional information we may need for a correct diagnosis. The complete freedom of the mucous membrane from any trace of exudate will dispose of any suspicion of diphtheria or laryngeal croup.

Prognosis. Conditional upon the cause of the affection, the prognosis will be either entirely favorable or will be the subject of some judicious caution. In other words, if the provoking cause has been a merely local and secondary infection, such as that associated with an infective angina, the prospect of prompt and permanent cure is excellent; whereas if the suppurative process is but a manifestation of chronic tuberculous disease of the vertebræ, the probability both of recurrence and of prolonged

treatment will be greatly increased. The few fatalities that have been recorded as due to pharyngeal abscess have ensued upon sudden rupture and evacuation of the abscess cavity during sleep, asphyxiation having been the immediate cause of death.

Treatment. It is self-evident that if the presence of pus can be detected it should be released at once. The selection of the route by which the abscess shall be opened will be influenced by the cause which has led to its formation. If it is a strictly local condition due to accidental infection its direct incision by way of the mouth will be perfectly safe and satisfactory. The patient is held by an assistant, the mouth widely opened by a gag, and the head and body inclined well forward. In this position the danger of pus entering the larynx in any quantity will be greatly lessened, but if the abscess should be of unusual size the adoption of the Trendelenburg posture will entirely eliminate this possibility. The base of the tongue being well depressed, a curved bistoury with but half an inch of its blade exposed is introduced within the mouth, and the abscess wall freely incised from its lowest point upward. A generous outlet for the pus made in this way will usually preclude any necessity for a repetition of the operation; but if we limit ourselves to a mere puncture this may have to be repeated several times. After the opening has been made pressure with the finger may be employed to empty the cavity as completely as possible. No after-treatment is necessary beyond cleansing and the prevention of any reaccumulation of the pus. In those cases, however, where the neighboring lymphatic glands are seriously implicated, and where the abscess is plainly dependent upon chronic spinal disease, the preferable route for its evacuation will be through the cervical tissues.

The anterior border of the sternocleidomastoid muscle will mark the point of the primary incision, and then, the large vessels of the neck being successively pushed aside, our way is dissected inward until the sac of the abscess protrudes into the

field. This path of communication provides us with a channel for subsequent drainage, and this can be kept patent by the introduction of a tube or by packing with antiseptic gauze. It goes without saying that the adoption of this external route of operation involves the employment of general anæsthesia.

SYPHILIS OF THE FAUCES AND PHARYNX.

The syphilitic manifestations most frequently seen in this region are the late form of the congenital and the secondary and tertiary forms of the acquired disease.

The chancre is of such very rare occurrence in the fauces that few of us ever discover the lesion in that situation. Still, we should always be on our guard and study very carefully any suspicious sore that we may find upon the tonsil, the faucial pillars, or the base of the tongue. A clear history of infection or one that will justify suspicion, together with an ulcer in this region, of recent origin and having an inflamed, swollen, and indurated base, and, in addition, a chain of enlarged glands leading from the angle of the jaw to those of the posterior cervical region—all this will certainly suffice for a diagnosis of chancre and prompt the immediate adoption of antisyphilitic treatment. The local treatment should consist of thorough cleansing, peroxide of hydrogen assisting in this, and then the application to the ulcer of the solid stick or of a 2-drachm solution of silver. This should be repeated daily until the completion of cicatrization.

Secondary syphilis manifests itself in the mouth and pharyngo-faucial region, first by a number of symmetrically distributed areas of congestion which give the mucous membrane a mottled appearance, and later by the development of "mucous patches." These latter are commonly found upon the buccal mucous membrane, the faucial pillars, the uvula and velum, and the tip and edges of the tongue. They are slightly elevated above the surface of the surrounding membrane, and their grayish appearance

is the result of thickening of their surface epithelium and some infiltration of the immediately adjacent tissue.

The subjective symptoms accompanying this affection are scarcely noticeable. The patient rarely complains of anything more than a little uneasiness or discomfort in the throat.

The local treatment consists simply of cleansing and the daily application to each mucous patch of the solid stick of silver. A lozenge of chlorate of potash is a serviceable addition, and the patient should be enjoined to carefully cleanse the teeth two or three times daily with a soft brush.

The characteristic lesions of tertiary syphilis may make their appearance at any time after the lapse of two years from the date of infection. They consist of ulcerations which mark the degeneration of gummatous deposit. They display a predilection for the faucial arches, the soft palate and uvula, and the lateral walls of the pharynx. The hard palate and the posterior pharyngeal wall are not, as a rule, involved so early by some years as these first-named structures. The ulcers may be either superficial or deep, they extend rapidly, and, unless checked by treatment, occasion within a very few weeks an astonishing amount of destruction. The structures apt to show the greatest ravages are the faucial pillars, the uvula, and the soft palate. Portions or all of these may soften and melt away almost like snow beneath the mid-day sun. The subjective symptoms even of this phase of syphilis are seldom of a pronounced character. Pain is but trifling, and quite often it is not until there is some loss of palatal tissue (Fig. 74) that the alteration of the voice, the interference with articulation, and the regurgitation of fluids into the nose upon swallowing compel attention to the destructive process.

The diagnosis of this disease requires only its differentiation from cancer, and this may be easily effected by eliciting the history, noting the absence of pain and of any enlargement of the submaxillary or anterior cervical glands, and, finally, the prompt response of the affection to antisyphilitic remedies.

The treatment, as in the earlier stages of the disease, should be both constitutional and local, and of a most energetic character. The iodides are to be given in rapidly ascending doses, and mercury administered by the mouth, inunction, or deep injection.

FIG. 74.



Syphilitic ulceration of soft palate.

Locally, any application is to be prefaced by the most thorough cleansing possible. Every shred of dead and sloughing tissue should be carefully removed and the living tissue beneath exposed for medication. Silver in stick or strong solution is the most efficient application, and it should of course be used daily.

CHAPTER XIII.

THE LARYNX.

ANATOMY AND PHYSIOLOGY.

THIS need be but a mere sketch of the subject, for the purpose only of refreshing the student's memory as to points with which his studies and dissections will have already made him more or less familiar.

The larynx is a cartilaginous box capping the tracheal tube. Its skeleton is made up of nine cartilages—three single and three in pairs, the former being the cricoid, thyroid, and epiglottis, the latter the two arytenoids, two of Santonini, and two of Wrisberg.

The cricoid forms the base of the structure and the support of the other cartilages. Resembling a seal ring, from which it derives its name, it is broad and thick posteriorly, narrow and thin in front.

The thyroid is composed of two broad lateral plates which are united anteriorly at rather an acute angle. Internally and attached by its apex within this receding angle is the epiglottis. Its base projects upward and backward.

The two arytenoids rest upon two articular facets upon the upper border of the cricoid. They are situated posteriorly, one on either side of the central plate of this ring cartilage. Upon the apices of the arytenoids are the cartilages of Santonini, and external to these are the cartilages of Wrisberg embedded in the substance of the aryepiglottic folds.

These different parts are all firmly united by an enveloping sheath of elastic connective tissue which forms membranes and

ligaments in certain situations, all of which contribute to the functional purposes of the larynx.

Two folds of this connective tissue on each side are of special prominence and importance, the upper one being the ventricular band and the lower the vocal cord. Between them is a recess or pocket called the *ventricle* of the larynx. The vocal cords are

FIG. 75.



FIG. 76.

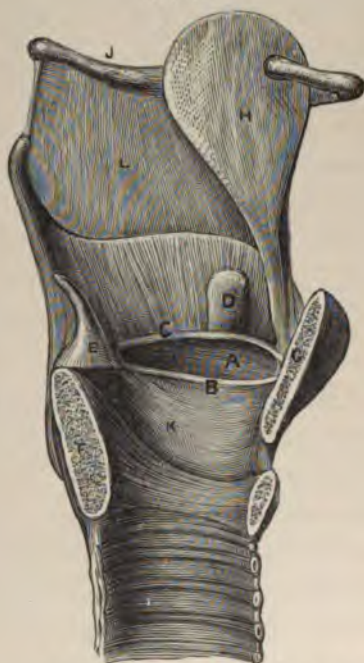


FIG. 75.—Hyoid bone and the laryngeal cartilages (ELLIS): G, body of the hyoid bone; H, large cornu; J, small cornu; A, epiglottis; B, thyroid cartilage; C, arytenoid cartilage; D, cricoid cartilage; E, upper cornu; and F, lower cornu of the thyroid cartilage.

FIG. 76.—Vocal apparatus, on a vertical section of the larynx (ELLIS): A, ventricle of the larynx; B, vocal cord; C, ventricular band; D, sacculus laryngis; E, arytenoid cartilage; F, cricoid cartilage; G, thyroid cartilage; H, epiglottis; K, cricothyroid ligament; L, thyrohyoid membrane.

two bands of yellow elastic tissue stretched between the anterior angle of the thyroid and the base of the arytenoids. Normally they are white in color, and are covered by an epithelium of squamous type. The movement and the tension of these cords are controlled by the intrinsic muscles of the larynx, and these are :

The *crico-arytenoidei laterales*. These rotate the vocal processes of the arytenoid cartilages inward, bring the edges of the cords in apposition, and are, therefore, the adductor muscles.

The *crico-arytenoidei postici*, which oppose the action of the first pair, and are the abductor muscles.

The *arytenoideus*. This muscle passes transversely between the two arytenoids, and its contraction approximates these two cartilages and closes the posterior or cartilaginous portion of the glottis.

The *thyro-arytenoidei* consist of two fasciculi—the external and internal—and they are intimately concerned with the tension and more delicate adjustment of the cords in tone production.

The *crico-thyroidei* also assist in regulating the tension of the cords after they have been approximated by the adductors.

The *aryepiglottici* exert a sphincter-like action upon the borders of the laryngeal entrance.

The laryngeal mucous membrane varies in thickness in different portions of the cavity, in the number of glands that it contains, and in the character of its epithelium. The glands are especially abundant in those portions that are functionally most active not only in phonation, but in deglutition and respiration; therefore we find a plentiful supply of them about the upper margin of the posterior surface of the larynx, in the ventricular bands, and in the ventricles.

The epithelium of the epiglottic mucous membrane is of the squamous type, as is also that upon the upper surface of the aryepiglottic folds. These structures, forming the aperture of the larynx, are most exposed. This same variety of epithelium is present upon the vocal cords. All other portions of the mucous membrane have the columnar ciliated epithelium. The innervation of the larynx is supplied entirely by the pneumogastric, and will be found in detail in the section dealing with the neuroses of this organ.

DISEASES OF THE LARYNX.

The mucous membrane of the larynx will naturally reflect in its vascular supply those constitutional conditions with which anæmia or plethora are associated. Laryngeal anæmia or hyperæmia, however, are not to be regarded as diseases, and, although they may occasion at times appreciable symptoms, they are more suggestive of the need for general treatment than for any local medication.

Acute Laryngitis.

I shall decline to adopt with this disease, as with the same affection of the pharynx, the needlessly numerous subdivisions that have been laboriously evolved by some authors. A clear comprehension of the nature and course of the disease is in no wise facilitated by this over-refinement of classification, and it is apt rather to embarrass than to be of any practical assistance to the student.

Acute catarrhal inflammation of the larynx is essentially the same process as inflammation occurring in any other portion of the respiratory mucous membrane, and the special symptoms accompanying it are due to the anatomical features of the larynx and to its extremely important and highly specialized functions.

Etiology. All of the causes that are involved at one time or another in the production of acute pharyngitis may be equally energetic in provoking laryngeal inflammation, but certain of them are particularly aggressive. Chief of these is excessive and unskilful use of the voice. The man who is forever talking noisily and laughing boisterously; the woman who carries on her incessant conversation in an abnormally high-pitched key, with her larynx hoisted far above its proper position, and the child who is continually shrieking, whether in play or in pain—these are the people who are especially prone to develop this disease when they are exposed to any exciting cause. In these, as in professional voice users, there is always more or less of a physio-

logical congestion within the larynx, which needs but a slight provocation to become pathological. Tissue resistance is invariably lowered by this persistent and rather irritative hyperæmia, and an abrupt change from a warm to a cold atmosphere, particularly if dampness is associated with the latter, is an extremely frequent cause of an acute catarrh. If nasal obstruction and mouth-breathing are also present the conditions favoring acute disturbance are vastly increased. Likewise, the individual with a chronic bronchial or pulmonary cough, attended with an irritating expectoration, will be a ready victim to laryngitis.

Symptoms. Sensations of dryness and heat within the larynx are very quickly followed by some vocal disability. Simply a trifle husky at first, the voice soon becomes enfeebled, and, in spite of increased efforts at phonation—indeed, partly as a consequence of these—it usually dwindles to a whisper. Cough is almost always present; but, though it may be frequent and annoying, yet it is often scarcely much more than audible. Pain is very rarely complained of, and in the adult there is no dyspnoea. In children, however, the larynx being smaller, and there being a greater proportionate amount of swelling, noisy and difficult breathing is by no means infrequent.

The physical changes in the larynx include alterations of color, form, and secretion. The heightened color due to the capillary hyperæmia varies not only in degree, but it may affect different portions of the larynx with varying intensity. The vocal cords, for instance, may often retain their normal color throughout the disease, although the parts above them may be very deeply reddened by the inflammatory process. Usually, however, the cords become flushed within the first day or two, and this is increased by the cough and the frequent “hemming” in which the patient indulges. Changes of form are principally those occasioned by swelling, and this is most noticeable in the ventricular bands. To this may be added any alteration of the normal position of the cords, whether at rest or in action. Some

temporary paresis of the internal thyro-arytenoids leads to bowing of the cords (Fig. 77), and a similar affection of the transverse arytenoid makes closure of the posterior third of the glottis impossible. (Fig. 78.) Secretion is quite suspended for the first twenty-four or thirty-six hours of the disease, and then as it is gradually re-established the cough becomes moist and phonic, and the voice slowly regains its tone.

FIG. 77.



Paralysis of internal thyro-arytenoid muscles.

There is nothing obscure or unusual about the *pathology* of the disease, and inspection of the larynx with the mirror can scarcely fail to verify the *diagnosis* that the functional symptoms have suggested.

Prognosis. The prognosis has no concern with the life of the patient, but relates only to the probabilities of the disease

FIG. 78.



Paralysis of transverse arytenoid muscle.

becoming, through neglect or unfavorable conditions, subacute or perhaps chronic. The possibilities of its extension, however, to the trachea and bronchi should be remembered, and also the occasional occurrence of acute œdema, particularly when the laryngitis is a complicating incident of one of the infectious fevers.

Treatment. The general measures that are of service in ameliorating the disease include intestinal evacuation by means of small doses of calomel, followed by a saline; the confinement of the patient in a well-heated room, the atmosphere of which is kept moistened by the addition of steam; and the administration, in case there should be much systemic disturbance with elevation of temperature, of a vascular depressant combined with a diaphoretic. Frequent drop doses of the tinctures of aconite or gelsemium answer this purpose very well, and the cough may be quieted and the return of secretion hastened by giving every two hours a twenty-fifth of a grain each of morphine and tartar-emetic combined in a compressed tablet with small doses of ammonium chloride and ipecac. Moreover, the diet should be restricted to the simplest possible foods and *the use of the voice absolutely prohibited*. This last injunction leads all the rest in importance. Not even whispering should be permitted. The value of medicine is as nothing compared to that of rest for the inflamed laryngeal tissues; but there are few patients who realize this, and the majority of them must be cautioned again and again as to the necessity for silence. The local treatment is at first very mild and soothing. Gentle spraying of the nose and fauces with the Dobell solution, even though they be not involved in the inflammation, will lessen the patient's discomfort, and two or three times during the day a warm, sedative inhalation may be used. This may be prepared by pouring upon the surface of a pint of hot, steaming water a teaspoonful of the compound tincture of benzoin. Over the bowl containing this a napkin folded into a cone is placed, and through the opening left at the apex the medicated steam is inhaled for several minutes. Boiling water should not be used, since it is relaxing and will aggravate rather than relieve the vascular distention; but if one part of cool water—say at 60° F.—be added to two parts of boiling water, the right temperature and an abundance of steam will be obtained. Should cough be frequent and a trifle painful, a drop

or two of chloroform or a teaspoonful of paregoric may be added to the benzoin. After two days of this sedation the hyperæmia and hyperæsthesia of the larynx will be sufficiently reduced to permit the use of an astringent spray to it. An atomizer with a downward curving tip is desirable for this purpose, and a 10-grain solution of alum will be efficient. If this can be used in conjunction with the laryngeal mirror and accurately directed within the larynx, so much the better; but if the patient's throat is not sufficiently tractable to permit the use of the mirror the tongue may be drawn well out of the mouth, the atomizer tube carried almost to contact with the pharynx, and the tip then so directed that the spray will pass back of the edge of the epiglottis and enter the larynx. As secretion is re-established it may be liquefied and its expectoration facilitated by inhalations containing *ol. pinus sylvestris*, *ol. picis liq.*, or *ol. eucalyptus*; and if the congestion shows some disposition to linger, its disappearance may be promoted by the nightly application of the tincture of iodine to the skin covering the larynx.

Upon the termination of the attack the patient should be enjoined to carefully avoid any overuse of the voice for some time, and to be cautious about exposing himself to unfavorable weather conditions. It will be usually several weeks before the larynx completely regains its tone and normal resistance to disturbing influences.

Acute Œdematous Laryngitis.

This disease is commonly referred to as "œdema of the glottis," and while it does occur at times as a primary affection, yet these are the exceptional cases, the rule being that it is secondary to some other disease. When primary it is usually the result of exposure to intense cold when the body is not only overheated, but overfatigued. The resulting inflammation may be of more than ordinary violence, and, not meeting with the customary resistance offered by tissues in full vigor, serous infiltration of the

submucous cellular tissues rapidly occurs, attended by swelling and glottic obstruction. Traumatism, also, may be responsible for primary œdema, and this may consist either of some external violence, direct wounding of the laryngeal tissues by a foreign body, the inhalation of superheated steam, or the swallowing of scalding water or of some caustic. The diseases in connection with which acute laryngeal œdema may occur as a complication may be certain affections of the heart, the lungs, the kidneys, or the blood. It is not seldom an accompaniment of the specific inflammations of the larynx, syphilis and tuberculosis; and I have met with it in association with the perichondritis that now and then follows typhoid fever, erysipelas, or other systemic infections. The intensity of the symptoms naturally depends upon the extent of the cellular infiltration. The voice is quickly affected, perhaps to the point of complete extinction, but the most aggressive and alarming symptom is the dyspnœa. Inspiration is usually first impeded, but the addition of expiratory difficulty is not long delayed. The character of the cough is strongly suggestive of the condition that produces it, and the possibly painful efforts at deglutition likewise point to an obstructive lesion.

Inspection of the larynx reveals at once the nature of the affection. The portions of the larynx that show the greatest amount of œdema are those that contain the greatest amount of cellular tissue, viz., the ventricular bands, the aryepiglottic folds, and the arytenoid eminences. The color varies from the bright redness of an acute inflammatory œdema to the pale, waxy hue of an infiltration that is dropsical in its nature.

Pathology. The pathology of the disease is entirely obvious, the transudation of serum into the submucosa constituting about the only morbid phenomenon.

Diagnosis. The diagnosis can scarcely present any difficulty, the appearance of the swollen structures and the history of its rapid development admitting of no other interpretation than the right one.

Prognosis. The character of this depends upon the cause of the disturbance. If this be removable or controllable recovery from the existing attack becomes almost a certainty, but the possibility of an abrupt and dangerous recurrence should not be forgotten.

Treatment. The external application of cold by means of ice-bags, the Leiter coil, or some other contrivance will be of value. The same inhalations that were advised for the early stage of acute catarrhal laryngitis will be equally sedative here. Pilocarpine, given hypodermically in doses of from $\frac{1}{10}$ to $\frac{1}{4}$ of a grain, has frequently proved very effective in controlling the œdema, but some caution should be observed in its use. A much more active remedy, and one that can be used with perfect safety, is the extract of the suprarenal gland. This may be applied in solution directly to the affected tissue by means of the laryngeal applicator, or it may be used in the atomizer. Five grains of the powder may also be placed dry upon the tongue, and it will exert its remarkable vasoconstricting action upon the swollen membrane as it is dissolved in the saliva and is swallowed. If, however, any degree of dyspnœa be present the swollen tissue should be promptly scarified and drained of the effused serum. A guarded laryngeal lancet should be used, and with the aid of this and a sufficient illumination of the throat there is no particular difficulty about the little operation. Relief is usually immediate, and, although there may be a return of the œdematous swelling, it will be of lessened degree, and will probably not require a repetition of the scarification. If, however, the dyspnœa should persist and increase in spite of this measure we may conclude that the œdema involves as well the subglottic tissues, and our only remaining resort will be tracheotomy. The low operation should be performed in order that we may evade, as far as possible, the infiltrated tissues. Upon the recovery of the patient we should discover and remove any cause that might predispose to a repetition of the attack, and the patient should

be instructed to report immediately for examination in case of any future threatening of laryngeal disturbance. Delay may be fatal.

Chronic Laryngitis.

In view of the frequency, the almost universality, of chronic catarrhal processes within the nose, the postnasal space, and the pharynx, it is not surprising that chronic laryngeal catarrh is almost equally as common as they are. The same causes that lead to the establishment of catarrh in these higher portions of the air tract also favor its independent development in the larynx, but the invasion of this latter cavity is almost invariably secondary, and is the result of extension from above. Mouth-breathing, because of the drying and irritating effect upon the laryngeal mucous membrane of the direct admission of air to it, is a most potent cause of chronic catarrh; and when to this are added intemperate indulgence in alcohol and tobacco, and too often abuse of the voice, we have a combination that cannot fail to create the disease.

Pathology. The hypernutrition that accompanies the persistent vascular distention results in hyperplasia of the mucous membrane throughout its several layers, and marking the progress of this thickening of the membrane we have a considerable disturbance of secretion. The involvement of the vocal cords may be slight or severe, and it is in the professional voice user, particularly the vocalist, that we occasionally meet with the condition called "singer's nodes." These are little whitish elevations, usually about the size of a hempseed, upon the superior surface of the cords, and usually near the free edge. In long-standing and rather severe cases of laryngeal catarrh it sometimes happens that one or more erosions may develop at some portion of the mucous membrane. When they exist it is usually in the inter-arytenoid space or upon the vocal process of the cords, and while they are not at all serious in themselves, they should make us

cautious in prognosis and careful in our examination of the chest and the sputum. Virchow has described under the name of "pachydermia laryngis" a condition that consists simply in a rather excessive thickening at certain points within the larynx of the epithelial covering and the subepithelial tissues. Its favorite situation is the interarytenoid commissure, and at times also it is found upon the cartilaginous portion of the cords.

Symptoms. The character and degree of impairment of the voice make a fairly good index of the standing and severity of the disease. Although actual hoarseness may not be constant, yet there is always a certain amount of impurity of the voice, which, though slight, cannot escape detection by the trained ear. The degree of hoarseness varies considerably with the time of day, the bodily vigor of the patient, the atmospheric conditions, and the amount of use to which the voice has been subjected. In chronic laryngitis the voice tires very readily, and if the patient attempts to sing or to read aloud for any length of time it may be wholly lost.

Cough is present in a fair proportion of cases, but it usually sounds more like a voluntary effort to clear the throat than like the cough that accompanies disease of the lower portion of the air tract. It is short, abrupt, and shallow. It is very seldom that the ease of respiration is at all affected, and pain is even more exceptional.

Secretion is never abundant, but in the earlier months of the disease it is moderately increased and is expelled in compact, gelatinous little pellets that contain almost no admixture of air. In cases of long standing secretion becomes very scanty.

The appearance of the larynx is apt to change somewhat with the duration of the disease and to be influenced by the causes that have produced it. The congestion of the mucous membrane is usually more marked in certain localities than in others. The interarytenoid fold is, as a rule, deeply colored, and the arytenoid eminences and the ventricular bands are about equally affected.



Quite often the cords, instead of showing general injection, present only a thin line of redness upon their free edges.

Permanent thickening of the tissues is in proportion to the severity and the length of standing of the disease, but temporary swelling may come and go in response to brief disturbing influences. The mirror will also show the alterations in the quantity and character of the secretion. Shreds and strings of mucus are seen upon and stretching between the cords, and this may be either colorless, or, in the mouth-breather, darkened by a quantity of inhaled dust. In very old cases, where the condition termed "laryngitis sicca" is present, crusts of dried mucus are commonly found upon the posterior commissure, clinging to the ventricular bands or enveloping the cords.

Prognosis. The prognosis of this disease is favorable enough, providing the patient is both able and willing to submit himself to a rather prolonged course of treatment and to eliminate all those causes that arise from his own vices or hygienic errors.

Treatment. *General.* This should take precedence of the local measures, because until every factor which contributed to the maintenance of the disease is rendered inactive we cannot hope that any strictly local treatment will be capable of effecting improvement. It is important to combat any constitutional affection—syphilis or tuberculosis—and, also, any of the diatheses that may obstruct recovery. Functional rest is almost as important in this as in the acute form of the disease, and, therefore, any condition, be it above or below the larynx, that can occasion cough should be removed or modified. The larynx should be protected, also, from foreign irritants of any kind, and these may be found in articles of food or drink or perhaps in atmospheric impurities. It is absolutely essential that the nose and pharynx shall be put and kept in as nearly a state of perfect health as possible.

Local treatment will be carried out by the use of solutions in spray or upon the laryngeal applicator, of powders by insuffla-

tion, of lozenges, and, occasionally, of inhalations. Alum or chloride of zinc in 10-grain solution make excellent astringent sprays, and if they are accurately introduced within the larynx by the aid of the mirror and the laryngeal atomizer their effect will be so much the more quickly apparent. With skilful handling of instruments it is astonishing how soon the larynx overcomes its repugnance to any form of direct treatment. In obstinate cases stronger zinc solutions may be used upon the applicator, or we may employ, by means of the insufflator, a powder of equal parts of alum and sacch. lact., or one of zinc sulphat. and sacch. lact. in the same proportions. If the larynx is very dry, even to the point of having crusts of dried mucus within it, ichthyol in 20, 30, or 50 per cent. solution is an excellent remedy for use upon the applicator. The presence of erosions or of simple catarrhal ulcers will call for the employment of silver nitrate solutions, 10 to 20 grains to the ounce. In case there is much irritative cough, due perhaps to some associated tracheitis, the stimulating inhalations suggested for the later stages of acute laryngitis are often of value. Much comfort and benefit are also to be derived at times from the use of certain remedies in lozenge form, such as borax, alum, benzoic acid, cubeb, chlorate of potash, chloride of ammonium, etc.

Tuberculous Laryngitis.

Although primary laryngeal tuberculosis is possible, and has been accurately observed in a small number of reported cases, yet it is relatively extremely rare and need not be separately considered.

The frequency of secondary invasion of the larynx has been demonstrated by Heinze, who in autopsies of 1226 cases dying of pulmonary phthisis found that the larynx presented unmistakable evidences of the disease in 51.3 per cent. The path of infection is largely conjectural, but the probabilities are that when the disease is consequent upon pulmonary tuberculosis the bacilli reach

the deeper laryngeal tissues through some imperceptible breach of epithelial integrity; whereas when the primary infection has occurred in the upper portions of the air or digestive tracts—in the pharyngeal, faucial, or lingual tonsils for instance—the lymph channels are probably the routes by which the larynx is reached.

Etiology. A simple chronic catarrh of the larynx in association with severe and long-continued depression of the general vitality becomes a powerful predisponent to tubercular mischief. The male being the more frequent subject of catarrh, it is in this sex that the majority of cases of laryngeal tuberculosis occur, the proportion between the two sexes being as about three to two.

Morbid Anatomy. General anæmia of the laryngeal mucous membrane precedes for a variable period of time the infiltration and tumefaction that are usually the first recognizable evidences of tuberculous deposit. The infiltration may be general, but it is more often limited to certain portions of the larynx. Of these the favorite is the interarytenoid fold, probably because of the comparative abundance of loose cellular tissue in this region, and of the fact that the sputum collects and may remain here for some time before being expectorated. (Plate I., Fig. 5.) The tissue enveloping the arytenoid cartilages is another seat of predilection, and next to this we may rank the aryepiglottic folds. In those, however, whose work compels more than ordinarily hard usage of the voice it is not infrequent for the vocal cords and the ventricular bands to be the parts earliest affected. The epiglottis often escapes altogether, but if attacked it is usually late. (Plate VIII., Fig. 2.) Progress of the disease leads to necrosis and ulceration. Tuberculous ulcers in the larynx are usually small, multiple, and rather shallow. Their edges are uneven, "worm-eaten," and slightly elevated above the surrounding tissue.

The laryngeal cartilages, particularly the arytenoids and the cricoid, are quite often the seat of necrosis consequent upon an extensive infiltration of their perichondrium.

PLATE VIII.



Fig. 1.—Laryngeal Image from a Case of Phthisis, showing the pyriform swelling of the arytenoid cartilages.

Fig. 2.—Tubercular Ulceration of the Epiglottis and Tubercular Nodules on the Ary-epiglottic Folds.

Fig. 3.—Syphilitic Ulceration of the Vocal Cords and of the Interarytenoid Space.

Fig. 4.—Fibro-cellular Tumor on the Right Vocal Cord.

Fig. 5.—A large Papillomatous Tumor springing from the Right Ventricular Band.

Fig. 6.—A pin embedded in the Posterior Portion of the Right Vocal Cord.

The mirror will show wide variations in the laryngeal image, according to the stage of the disease at which it is used. In that of invasion general anæmia of the larynx is the rule, and one of the earliest added signs of the disease is the development upon the anterior surface of the interarytenoid fold of pale, flabby projections of a papillomatous appearance. Although something of a similar character may occur in syphilis, or even in simple chronic catarrh, yet they are extremely characteristic of tuberculosis, and are always to be regarded with suspicion. With nearly equal frequency we find the almost pathognomonic pyriform swelling of one or both arytenoid eminences, and this may and usually does involve much or all of the aryepiglottic fold. (Plate VIII., Fig. 1.) The tumefaction is enormous at times, and may entirely hide the inferior portions of the larynx. Another occasional symptom of early occurrence is a moderate paresis of one or both vocal cords, and with this may be associated more or less injection of them. Any infiltration of the thin mucous covering of the epiglottis can scarcely avoid exciting a perichondritis, and this may be attended with extraordinary tumefaction.

Tuberculous new-growths—tuberculomata—occur in any portion of the larynx, and are characterized by their paleness, their uneven surface, and their usually broad base.

Symptoms. The voice is affected from the commencement of the disease, and this affection may range from slight enfeeblement to complete extinction. Pain prior to ulceration is practically absent during functional rest, and it is not severe even during action. At a stage of the disease, however, when ulceration has occurred upon the epiglottis or upon the outer surface of the margin of the laryngeal cavity, the act of swallowing may occasion such agonizing pain that many patients would rather starve than attempt it. Swelling of such degree as to occasion any marked dyspnoea is rather exceptional. Cough of varying frequency and character is an invariable accompaniment, and the expectoration, gelatinous and scanty at first, becomes abundant

and mucopurulent upon the appearance of ulceration. When the ulceration is extensive, and particularly if necrosis of the cartilages be present, an offensive and quite characteristic odor is a symptom of some prominence.

Diagnosis. Diagnosis, in many cases requiring but a moment's investigation, in others may require several days of patient and careful observation. The discovery in the one case of the primary disease process, and the presence of all the dyscrasic phenomena that usually accompany it, removes at once any doubt as to the nature of the laryngeal lesion; but in another instance which may present no collateral or corroborative evidence of this kind we must trust entirely to the more or less distinctive appearances afforded by the larynx itself. The description just given of these physical alterations need not be repeated, and we have only to select for emphasis the several points the association of which will enable us to exclude carcinoma and syphilis. The ulcer of syphilis that we find in the larynx is deep and sharply defined, and is surrounded by a hyperæmic mucous membrane, all of which is in marked contrast to the tuberculous ulcer. The syphilitic lesion extends rapidly and deeply, is attended by scarcely any pain or impairment of the general health, and other evidences of present or past activity of the disease are usually to be found. Old cicatrices and adhesions involving the pharynx and fauces are eloquent of previous ulceration. If doubt still lingers, a few days' administration of the iodides will generally enable us to reach a positive decision. It must always be borne in mind, however, that tuberculosis and syphilis may coexist, and if but one of them should be recognized and treated the outcome will scarcely prove happy.

Carcinoma, almost from its inception, is characterized by constant lancinating pain. This and its encroachment upon the laryngeal cavity commonly attract attention long before the occurrence of ulceration. The mucous membrane is hyperæmic, and when ulceration once begins it progresses steadily, although rather

slowly. The cachexia of the late stages is of considerable diagnostic assistance.

Notwithstanding these several differences, however, the diagnosis is often a matter of extreme difficulty, even for the expert laryngologist, and the beginner should remember that it is frequently only the characteristic course of the disease during, perhaps, many days of observation that enables us to finally assure ourselves of its nature.

Prognosis. The fact that in the large majority of cases the prognosis is far from favorable is due to the almost hopelessly late period at which the laryngologist first sees them. If in all cases of pulmonary tuberculosis the laryngologist were associated with the general adviser from the commencement of treatment, not only would laryngeal involvement be much more rare, but in the event of its occurrence it could, in all probability, be restrained within the limits of mere discomfort throughout the further progress of the pulmonary disease. The prospect of cure in any case will largely depend upon the amenability of the primary disease in the lungs and upon the remaining amount of vitality that the patient may possess. In unfavorable cases the probable duration of life will be the longer in proportion as the ulceration is intralaryngeal and sheltered from contact with articles of food. The presence of intractable ulcers upon the border of the epiglottis, or upon the pharyngeal aspect of the aryteno-epiglottic folds, or the posterior commissure, will seriously interfere with nutrition by making deglutition so painful that it cannot be endured. The inevitably rapid fatal effect of such a condition is plainly obvious. In the case of only average severity, however, my view of the prognosis of this disease is not nearly so gloomy as that which seems to be almost universal among general practitioners and even among a large proportion of laryngologists. The facts that quite a number of indisputable instances of spontaneous healing of tuberculous ulceration within the larynx have been reported, and that many of us have secured cicatrization of

these lesions, even while the tuberculous process situated elsewhere has steadily progressed, have been sufficient to convince me that the natural tendency of the tuberculous larynx is to get well, provided it is given a fair chance. Does not the extreme rarity of primary tuberculous infection of the larynx, in spite of its exposed position, favor the view that not only is its defensive power against this species of microbic infection very great, but that in the event of its occurrence this power will continue to contest the advance of the disease, and in all probability successfully, if it be reinforced by the assistance that we are able to extend to it? The nature of this assistance will, of course, be largely influenced by the widely varying conditions encountered in different cases; but should the disease be, as we know it almost always is, a séquence of the same disease within the lung, the value of our assistance will depend to a great extent upon our ability to control the primary disease, and so to protect the larynx from continued reinfection. From this point of view it does make a very material difference whether the infection comes from within through the medium of the blood and lymph vessels, or from without through some breach in the integrity of the epithelial covering of the mucous membrane. In the one case we are practically helpless to prevent it; in the other we can often make a winning fight.

Treatment. However laryngologists may differ as to the principles and details of local treatment, we are probably very nearly of one mind as to its general management. In case the patient can afford the advantages which change of climate and altitude may secure him, our selection of the new locality will be conditional upon so many of the features present in each case that no strict rules can be formulated for our guidance. Whether it shall be high, cold, and dry, or, on the other hand, low, warm, and moist, or whether it shall have various modifications of these climatic peculiarities, is a question the wise decision of which will often require much reflection and an intimate knowledge of

our patient. Whatever the environment, however, there are certain hygienic principles relating to the tuberculous larynx that must be rigidly enforced. To put it briefly, the removal or suppression of everything that can possibly act as an irritant must be attempted. Above all other considerations I should place the need of functional rest. Barring the two physiological sources of disturbance—respiration and deglutition—we can usually moderate, at least, the activity of all others. The use of the voice, either phonic or in whisper, must be absolutely prohibited. Knowing what a trial this is to the average patient and how few of them have sufficient self-control to observe strict silence, we may be disposed to be lenient in this matter and to be content with lessened use of the voice instead of its entire abandonment. It is, I think, a mistaken kindness this, because not only is phonation injurious in itself, but it almost inevitably provokes increased frequency of cough and more or less vigorous clearing of the throat in order that the voice may be rendered for the moment more distinct. It is infinitely better to exact a promise of silence from the patient and to have him conduct his communications entirely in writing; and in order to make this practicable it may be necessary at times for the patient to change his occupation or to relinquish work altogether. The subject of food and its adaptation to the intensely sensitive condition of the larynx is one that requires eternal vigilance, and we cannot be too explicit in our instructions and insistent upon their observance.

If there is ever any truth in the old saying that “there is nothing so bad for a cough as coughing,” surely it is when we have a tuberculous larynx to deal with. The topical treatment of the larynx will of course greatly modify the frequency and character of the cough; but while no doubt it would be better for the stomach’s sake to wholly avoid the internal use of drugs for this purpose, yet there are critical moments in the course of this disease when resort to them is entirely judicious, and will

be justified by the good effects of the increased rest that they secure.

In connection with the cough I think this an opportune moment to speak of a procedure that has not, it seems to me, achieved as wide a popularity and general use as it deserves. I mean the intratracheal injection of solutions of menthol, guaiacol, or eucalyptol in olive or some other oil. For routine employment not only in this but in several other affections of the air tract, there is scarcely anything that I hold in higher favor than this. I do not resort to it with any idea that it exerts, *directly*, the least salutary influence upon the pulmonary disease, I do not believe that it does, but there is no room for argument concerning the favorable effect that it has both upon the character of the cough and that of the sputum. This latter becomes thinner in consistence and easier of expectoration, and as a consequence the cough lessens, both in violence and frequency. Whether the injection of these solutions lessens also the infective quality of the sputum I shall not discuss, but it does not seem unlikely.

We naturally divide the local treatment of the tuberculous larynx into that of the pre-ulcerative stage and that which becomes appropriate when ulceration has commenced. I shall dwell but a moment upon the treatment of the first of these. We will be guided in our selection of remedies by ordinary general principles, the measures employed varying of course according to the state of vascularization of the tissues, the amount of infiltration, and the character and quantity of the expectoration. At one time astringent and at another stimulating sprays will be of service, and inhalations partaking of one or the other of these qualities may also be used with benefit. I cannot help thinking that the use of inhalations or of finely comminuted sprays is much preferable to the introduction of powders within the larynx, at least before the occurrence of ulceration.

With beginning disintegration of the infiltrated tissues and the

appearance of ulceration our treatment will not only become more elaborate and make greater demands upon our technical skill, but there will arise the added necessity for its more frequent repetition. With regard to this latter point I have gradually become quite confident that the results of treatment of tuberculous ulceration of the larynx would be much more encouraging, much more satisfactory—that, in other words, our proportion of cures would be greatly increased—if it were always practicable for us to see our patient three or four times each day instead of but once, or even less frequently than this. If tissue necrosis and extension of infiltration are disposed to be at all active, visits at such wide intervals as alternate days can have but little more than a retarding influence upon the destructive process. Its complete arrest can scarcely be hoped for if our treatment be less aggressive than the disease itself. There are many difficulties, of course, which combine to hamper both the patient and ourselves in this matter; but whatever mutual sacrifices may be necessary to the end of securing this frequency of treatment, they will be found, I think, quite worth the making. The thorough cleansing of the larynx every few hours, the complete removal from it of the mass of bronchopulmonary sputum, mingled with the *débris* of local necrosis and purulent discharge, while greatly facilitating the action of any remedial application is of itself of distinct value as permitting if not promoting cicatrization. It is extremely unfortunate that the victim of this disease cannot clear his larynx as successfully as he can his nose or nasopharynx. It is we who must do this for him, and the more often and thoroughly we do it the greater will be the certainty and rapidity of his improvement. I do not suppose it would be practicable, but I cannot help wishing, nevertheless, that we might have sanitariums for those cases of tuberculosis in which the larynx is the more seriously involved organ. Under such circumstances cleansing and medication could be made an almost continuous performance, and I am sure that many cases

which now defy our efforts could be brought under early control and conducted to ultimate cure. The alkaline solution in spray form, supplemented, if necessary, by the direct application of peroxide of hydrogen with the tuft of cotton, will usually rid the larynx of its irritating contents and give us an approximately clean surface for the action of medicaments. In spite of the fact that it has been termed antiquated and even barbarous by an occasional overzealous advocate of some other remedy, I am as well satisfied with lactic acid as I could be with anything not possessing actually specific properties. I believe that in it we have a remedy that, properly used, will cure any case that may be reasonably regarded as curable. I believe, also, that a 50 per cent. solution used twice each day will be more effective than the pure acid used but once daily. I need not emphasize the necessity for energy in its application, and if the larynx has been previously sufficiently cocaineized my experience has never furnished me with an instance that would afford the least justification for the use of such an adjective as barbarous in referring to it. This may have been an exceptional experience, but I have never heard anything but the mildest complaint of its painfulness, and seldom even this. It is immediately after this application that I use the intratracheal injection already mentioned; and, finally, in those cases when both the depth and superficial extent of ulceration are above the average, I complete the treatment by the insufflation of iodoform in combination with some indifferent powder. In its entirety this treatment no doubt consumes a large amount of time, but we will usually be compensated by the results which it secures.

The problem of controlling the agonizing pain that so often accompanies this ulcerative process is one of acknowledged difficulty. Of the small number of remedies that have any value in this emergency, orthoform has seemed to me the most dependable. Its efficiency is influenced somewhat by the method of its use. Freudenthal's emulsion, though therapeutically entirely

satisfactory, is inconveniently elaborate (see *Formulary*), and, moreover, it is important that it be of recent preparation. Equally efficient, I have found, and much more convenient is an oily solution of the drug. Albolene, benzoinol, and others of the petroleum derivatives have a very feeble solvent power, and have, therefore, a limited value as vehicles. Much more active than these is an oil recently introduced under the name of "basol," which will hold in perfect solution 15 grains of orthoform and 10 grains of iodoform to the ounce. This solution carried to the ulcerated larynx, either by means of the cotton-mop or sprayed from an atomizer, adheres to the surfaces quite long enough to exert the full effect of the remedies that it contains.

This discussion of the local treatment of laryngeal tuberculosis would be far from complete without some reference to the surgical procedures that have been periodically eulogized for employment in this disease. Personally, I am not an advocate of this mode of intervention. In the abstract, the removal by the curette of necrosed tissue, preceded, if necessary, by the incision of infiltrated areas, seems perfectly rational and judicious, and from this point of view probably few would question its propriety; but, as a matter of fact, this method, instead of being well adapted to and attended by favorable results in all or even a majority of cases, has been found, on the contrary, to be applicable to only a carefully selected few. Even those who champion its cause most ardently not only admit its limitations, but insist upon a most accurate discrimination in the choice of cases. Even with the exercise of this care, however, it is still debatable whether the results that it gives are so far superior to those obtainable from the less heroic measures that I have detailed, as to compensate for the inflammatory reaction, the intense suffering, and the marked though temporary systemic depression exhibited by the patient.

The special pathological conditions that would demand or justify a resort to tracheotomy or laryngo-fissure are of such

exceptional occurrence, and so readily suggest themselves to the mind, that any extended reference to them is uncalled for.

That we may be furnished with something of specific virtue through the investigations now being conducted with Koch's new tuberculin and its several modifications is a possible outcome that we cannot but await with intense interest. In conclusion, I have only to reiterate my belief that the cure of tuberculous laryngitis, while it will continue to depend to a certain extent upon the stage and activity of the pulmonary disease and what remains of the general vitality of the patient, will do so to an almost equal extent upon the frequency and the patient thoroughness with which we carry out whatever local treatment we may adopt.

I am much less pessimistic now as to the curability of this disease than I was a dozen or even a half-dozen years ago; and where once we may have dreaded the appearance of these patients in our offices, we can now greet them cheerfully and with the assurance that, though perhaps we may fail to cure, we cannot fail to afford them that relief from suffering which robs approaching death of half its sting.

Syphilitic Laryngitis.

SECONDARY.

Although manifestations of secondary syphilis in the larynx are not uncommon, yet they seldom occasion any great symptomatic disturbance, and the disease may appear and disappear from this region without arousing a suspicion of anything more than a subacute catarrhal inflammation, somewhat obstinate and prolonged, perhaps, but nevertheless of simple nature. Apparently innocent as it may often be, however, its almost invariable tendency is to leave a persistent irritative hyperemia in its wake that will strongly predispose the individual to the far more serious tertiary phenomena of the disease.

TERTIARY.

The early stage of this affection is usually characterized either by a diffuse infiltration of the laryngeal tissues or by one that is circumscribed and limited at first perhaps to the mucous or sub-mucous layers. The first method of invasion may implicate all the structural details of the larynx, the muscles and perichondrium being included in the process as well as the more superficial tissues. The second method of attack produces localized nodular swellings, which look for a time as though they were superimposed upon and distinct from the deeper layers. Both of these variations of the disease—and they may coexist, by the way—are merely preliminary to an ulcerative process which usually occasions extensive destruction, and is followed, in case of recovery, by cicatrizations which display a unique tendency to contraction, and are responsible, at times, for seriously obstructive deformities.

By either method the involvement of the larynx is apt to be extremely insidious and unmarked by symptoms that attract more than momentary attention. For weeks perhaps this infiltration may proceed until, owing to its density and the implication of the vessel walls, central softening—fatty degeneration—occurs, followed by necrosis of the overlying tissue and formation of the characteristic ulcers. These are sharp-edged and deep, have a greenish-gray surface and a highly reddened mucous membrane about them. (Plate I., Fig. 6.) There is some difference of opinion as to the favorite locality for their occurrence. Functional activity and exposure to irritation seem to influence this somewhat, and, as a consequence, we find that the vocal cords and the epiglottis are involved with almost equal frequency, and that the interarytenoid fold is a good second to either of them. (Plate VIII., Fig. 3.)

As has been said, the disease is remarkable for the prolonged absence of symptoms. Were it not for the voice it is probable

that but little notice would be attracted to the larynx until perhaps ulceration had become quite extensive. This vocal change, however, is highly significant—almost pathognomonic, indeed, to the experienced ear—and will generally arouse suspicion even during the first few weeks of infiltration and in the absence of any collateral systemic symptoms. Upon or shortly after the commencement of tissue destruction, however, the patient may become conscious of moderate or at times of a severe stabbing and burning pain, and of interference with the act of swallowing usually proportionate to the amount of epiglottic involvement. Secretion is not apt to be abundant, and while, therefore, the throat may be cleared frequently by voluntary effort, cough and expectoration are not symptoms of any prominence. Embarrassment of respiration is of late occurrence, as a rule, and is evidence of the cicatricial stenoses which commonly follow the subsidence of ulceration. Another sequel of ulceration which may likewise occasion obstructive symptoms is the marked peripheral thickening which often occurs around the site of some tissue loss.

In cases in which the preliminary infiltration has been very extensive and in which, during the subsequent ulceration, mixed infection has perhaps occurred, we are not unlikely to find serious ravages among the deeper tissues, the perichondrium, the cartilages themselves, and the articulations. Destruction of these parts is apt to be accompanied by the expulsion of large sequestra.

Diagnosis. Any difficulty in the diagnosis of syphilitic laryngitis is usually limited to the pre-ulcerative stage; but even then a patient and tactful investigation of the history, a careful search of the whole body, if necessary, for evidences of previous specific disease, the marked general hyperæmia of the laryngeal mucous membrane, and finally the resort to antisymphilitic treatment will seldom fail to dissipate doubt. We will of course attempt to exclude tuberculosis by examination of the chest and the sputum ;

and an additional point of value in this disease is its duration. When the infiltrated areas and gummatous swellings break down the characteristic appearance of the ulcers and their rapid extension will further illuminate our diagnostic pathway. The exclusion of malignant growth requires at times some little period of observation as to the rate of progress of the disease and the tendency to rapid degeneration of the infiltration.

Treatment. Any delay in treatment may be so dangerous that it is often judicious to commence even before our diagnosis is thoroughly established. The iodides alone should not be depended upon, but should be supplemented by mercurial inunctions or the intramuscular injection of that drug. Locally, there is no better agent for checking the advance of ulceration and limiting disintegration to the already dead tissue than nitrate of silver. It may be applied by means of small tufts of cotton in 120-grain solution, or the solid stick may be used instead. Thorough preliminary cleansing of the larynx and the removal of all secretion or loose necrotic tissue is of course essential. After cauterization with the silver, the insufflation of the iodoform powder (page 149) will both afford protection and hasten cicatrization. The stenoses which follow healing must be controlled by dilatation, by division with subsequent dilatation, or upon the failure of these methods to relieve dyspnœa we must resort to tracheotomy.

Neoplasms of the Larynx.

Although, histologically, they permit of a much more elaborate classification, yet it is quite sufficient for clinical purposes to divide these into benign and malignant.

As to the favoring and exciting factors in the causation of these new-growths there is more surmise than certainty; but if for the sake of brevity we may generalize, it is probable that any condition that will provoke and prolong an irritative laryngeal hyperæmia will do much to encourage their development.

(a) BENIGN NEOPLASMS.

Considering these in their order of frequency, we have first to mention that form which outnumbers all the others combined :

Papilloma. This, although not limited to any age, is most often encountered in young adults and children. It may occur as a number—a mass of small ones—or as one large growth, attaining perhaps the size of a walnut. (Plate VIII., Fig. 5.) The surface is usually uneven, granular, or mulberry-like, and the color a rather pale pink. (Plate I., Fig. 7.) Histologically, this tumor is a papillary fibro-epithelioma, its structure consisting of slender processes of connective tissue springing from a broad base, which are enveloped in an uncommonly thick covering of epithelium.

Fibroma. A number of other neoplastic formations or inflammatory hyperplasiæ are often diagnosed as fibroma ; but, as a matter of fact, this type of growth is very rare. It is almost pure connective-tissue tumor, usually of rather dense consistence and smooth surface, and is most often sessile. (Plate VIII., Fig. 4.)

Adenoma. This is generally of cystic form, and commonly originates in a dilated gland. The epiglottis is the favorite seat for adenomata, and they attain at times such size as to interfere with both respiration and deglutition.

Angioma. This variety, arising from dilatation of veins or capillaries, is seen very seldom. As might be expected, it is apt to undergo rapid alterations of size and color.

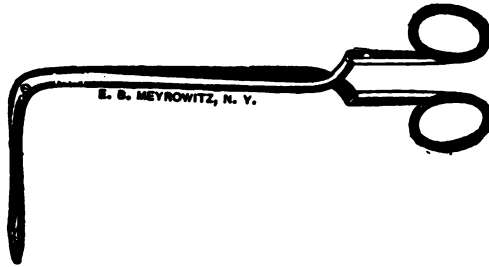
Other neoplasms that may be encountered at long intervals are the myxoma, the lipoma, and the chondroma.

Symptoms. The symptoms occasioned by the presence of a benign tumor within the larynx are apt to vary with its size and location. There is almost always more or less impairment of the voice. This alteration, though slight at times and intermittent, may amount at others to complete aphonia. Cough is of common occurrence, but the ear can usually detect that it is of an

irritative nature, and the fact that there is but little expectoration is of additional significance. Some of the larger growths upon the epiglottis or about the aperture of the larynx may interfere with both deglutition and respiration, but pain is conspicuous by its absence.

Treatment. The only curative treatment for these benign growths consists of course in their operative removal. It is scarcely likely that the general practitioner will undertake an operation that even the specialist of ripened years and experience approaches with no little trepidation. Intralaryngeal surgery demands an extraordinary amount of skill, and it is only by prolonged and constant practice that the two hands—the one holding

FIG. 79.

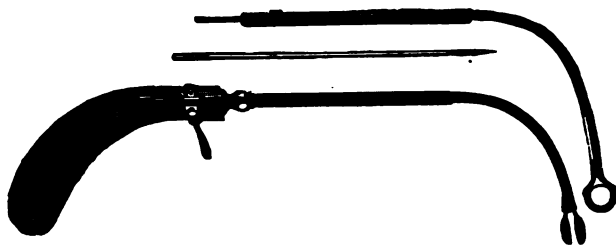


Mackenzie's laryngeal forceps.

the mirror, the other the operating instrument—can attain the necessary perfection of training. A cure is reported now and then of papillomata in the young by the spray or direct application to them of alcohol or the tincture of thuja, but very little dependence can be placed upon such means. Granting the possibility of this, however, for some days or a week or two previous to any resort to surgery it is always advisable to reduce as far as possible the irritability of the larynx by astringent sprays, and to accustom it to the touch of instruments by introducing within it the laryngeal probe or the cotton-wound applicator. The type of the growth, its size, and situation will influence our choice of instrument for its removal. This may be a curette, snare, knife,

sponge-probang, or forceps. The first step of the operation will be the thorough cocainization of the larynx. Much stronger solutions of this drug can be used in the larynx than would be safe in the nose, and to procure complete anæsthesia a 15 per cent. strength is usually necessary. The applicator carries this directly to the site of the growth, and after an interval of two or three minutes it is reapplied. Within a very few minutes, the tissues having become quite insensitive, the patient takes the tip of his tongue with his right hand, and the operator, using as large a laryngeal mirror as possible, introduces his forceps or other instrument, and should distinctly see what it is that he grasps with it. In these operations as little as possible should be left to

FIG. 80.



Seller's laryngeal guillotine with tube-forceps and laryngotome.

the sense of touch. The growth if small may be entirely removed at the first attempt; but if large may require several repetitions of the manœuvre. There is no hemorrhage worth mentioning, and the after-treatment requires nothing more than silence, the use of a little cracked ice, or perhaps an alum spray.

If for any reason the removal of these growths by endolaryngeal operation is impracticable, resort may be had to thyrotomy; but this should be a last resort, and only undertaken in case symptoms of laryngeal obstruction make operation imperative.

(b) MALIGNANT GROWTHS.

The two varieties of malignant growth that are of most frequent occurrence in the larynx are the epithelial and the sarcom-

atous. Our information concerning the origin of cancer is very limited. The influence of heredity has probably been much overestimated, and it no longer has the weight in diagnosis that it once had. The laryngeal cancers have been classified into *extrinsic* and *intrinsic*, the former including those involving the epiglottis, arytenoids, aryepiglottic folds, and pyriform sinuses, and the latter those affecting the vocal cords, the ventricular bands, and the interarytenoid folds, and, in addition, the infraglottic growths. Intrinsic laryngeal cancer is practically always primary. There is no uniformity in the appearances presented by different cases, and the laryngoscope will reveal a very great variety of image.

The *epithelioma* (Plate I., Fig. 8), whether it occurs upon the vocal cord, the posterior commissure, or the ventricular band, leads almost invariably to extensive infiltration of the adjoining tissues, and hence to marked interference with function. This is one of the most significant effects of a cancerous growth. The tumor, if it originates in the deeper layers, may remain dormant for years; but when it once takes on activity its increase in size, the occurrence of ulceration, and the progress of tissue destruction are all rapid. Pain of a lancinating character is greatly in evidence, and subsequent to the superficial disintegration of tissue, moderate hemorrhages are not uncommon. A growth that is unilateral and that is accompanied by subjective symptoms much more pronounced than would seem to be warranted by its objective appearance is always a proper object of suspicion. If the patient has passed forty years of age the suspicion is the more justifiable. Glandular involvement is usually delayed until rather late in the disease, but their ultimate tumefaction sometimes reaches an extraordinary degree. The diagnosis is quite often made a positive one by the results of microscopical examination of a portion of the growth removed for the purpose. This means of diagnosis, however, is only open to the specialist.

Treatment. The treatment is of course exclusively surgical, and is only rational and of more than transient benefit when it effects the total extirpation of the growth together with a judicious amount of the peripheral healthy tissue. In lieu of so extensive and formidable an operation, tracheotomy will often mitigate the suffering of the patient and perhaps prolong life for some months.

If consent to operation is withheld it is not only justifiable, but a plain duty, to begin the systematic administration of morphine in gradually increasing doses, such as will render the patient but partially sensible of the agony that he would otherwise endure.

Sarcoma has its origin, as a rule, rather deep within the tissues of the larynx, springing from the endothelium or perhaps the adventitia of the bloodvessels and lymphatics. In its progress, the forms it assumes, the symptoms it occasions, and its final result there is little if any difference between it and the epithelial cancer just described.

The Laryngeal Neuroses.

SENSORY.

Anæsthesia will be encountered very seldom and is usually partial only. It evidences suspension of function of the superior laryngeal nerve, and the lesion causing this may be either peripheral or central. It is commonly associated with more or less motor disturbance. The symptom that attracts attention to it is the frequency with which food, liquid or solid enters the larynx and provokes attacks of coughing. The treatment will vary with the cause of the disorder. If it be a sequel of diphtheria, strychnine and faradization are of decided benefit; while if it be a symptom of bulbar paralysis, general treatment directed to the control of that disease will be indicated.

Hyperæsthesia and paræsthesia are usually dependent upon

some local cause, or may be symptomatic of some general disease which develops later.

MOTOR.

Impaired or suspended motility of the vocal cords may arise either from myopathic or neuropathic disturbance, the former affecting the muscles primarily, the latter their innervation. The first group, therefore, may be regarded as mechanical in their nature ; the second as neurotic.

(a) *Mechanical.*

Acute and chronic inflammations of the larynx may involve the muscles as well as the mucous membrane, and any infiltration of these will seriously interfere with their activity. Severe strain produced by overexertion in speaking or singing is a frequent cause of temporary disturbance of their function. Degenerative processes are also often responsible for a loss of energy, and these may accompany or follow any serious interference with general nutrition, such as is incident to tuberculosis, the intractable anæmias, or the acute infections like diphtheria, typhoid or typhus fevers, erysipelas, etc. The muscles may be affected singly or severally, and we may obtain in the mirror a great variety of images.

In addition to these myopathic alterations, another mechanical cause for impaired motility of the cords will be found in diminished mobility of the crico-arytenoid joint resulting from inflammation within or around it.

Symptoms. The symptoms accompanying these mechanical disturbances of motility are limited almost entirely to the larynx, and involve principally the functions of phonation and respiration. The voice may undergo a great variety of changes in its quality and power, and respiration may be embarrassed to a slight or very serious extent.

Diagnosis. The diagnosis will be based largely upon the history of each case, the manner of attack, and subsequent course

of events, and will be assisted very materially by a familiar acquaintance with the characteristic positions of the cords during phonation and respiration.

Treatment. Treatment will naturally seek to remove the primary cause of the trouble, and the restoration of muscular energy will often be greatly promoted by electrical excitation applied either within or from without the larynx.

(b) *Neurotic.*

Spasmodic affections of the vocal cords are not at all infrequent. They may be tonic or clonic in character and may involve any or all of the laryngeal muscles.

Laryngismus stridulus, laryngeal chorea, and laryngeal vertigo ("ictus laryngis"), although commonly described as distinct diseases are in reality but symptomatic disorders usually dependent upon central disease, yet often enough due to reflex irritation of some kind.

The so-called "laryngeal crises" of locomotor ataxia furnish an instance of tonic spasm of the adductor muscles. Clonic spasm follows meningeal inflammation at times, and may also be a symptom of disease of the medulla itself or irritation of it as a consequence of disease in its immediate vicinity.

The treatment of these affections is merely that of the disease which gives them birth. The "pseudo or false croup" of children will be suppressed by reducing the reflex excitability of the nerve centres and by removing from the upper air tract (the nose and throat), or from the gastro-intestinal canal, anything which can act as a source of irritation.

Paralyses.

Each inferior or recurrent laryngeal nerve supplies all the intrinsic muscles of its own side of the larynx with the exception of the crico-thyroid, the internal thyro-arytenoid, and glottidian. The motor innervation of these muscles

the corresponding superior laryngeal nerve, while the interarytenoid muscle derives its supply from both of these nerves.

It will economize the time of the student, without detracting from the practical value of this section, if, instead of separately considering the partial or complete paralysis of each individual muscle or pair of muscles, we review as briefly as possible the result of paralysis of one or other of the two nerves, the recurrent or the superior laryngeal. The muscles innervated by the recurrent are by far the ones most frequently affected, and their paralysis may be due either to disease of the spinal accessory nucleus in the floor of the fourth ventricle or to disease of, injury to, or pressure upon the trunk of the vagus or the recurrent nerve itself.

Of the causes which give rise to paralysis of central origin the best-known are softening of the medulla as the result of thrombosis or apoplectic effusion, tumors, aneurism pressing upon the bulb, abscesses, disease of the bulbar nuclei, syringomyelitis, lateral sclerosis, and cervical tabes. Another possible cause is the impaired nutrition resulting from the atheromatous changes of late syphilis in the arterial walls.

The lesions of the vagus that may occasion palsies are certain degenerative changes in the nerve, injury to it received through traumatism or during operation, or pressure upon it anywhere between its origin and the point at which the recurrent leaves it by aneurisms, malignant growths, or glandular enlargements.

Finally, the recurrent itself is very often at fault as the result of its participation in diseases of neighboring structures, and among these may be mentioned aneurism of the aortic arch or of the innominate artery, tuberculosis and accompanying pleurisy of the right apex, any of the diseases affecting the mediastinum and its contents, large bronchoceles, and malignant disease of the œsophagus.

Syphilis and diphtheria occasion quite often a toxic neuritis of the larynx. The effect may ensue upon other of the acute affections, as diphtheria, scarlatina, typhoid, grippe, or influenza.

It is now a well-established clinical fact that in laryngeal paralysis, be it either of central or peripheral origin, it is the abductor muscles of the cords that are first affected, and that it is only after some time that the adductor muscles display any loss of energy. This greater vulnerability of the abductor muscles is explained by the fact, demonstrated by Semon, that "there exists an actual difference in the biological composition of the laryngeal muscles and nerve-endings," and it is in consequence of this that complete paralysis of the recurrent is almost always at first a partial or abductor paralysis.

If we consider first then a unilateral paralysis of the abductor muscle—the posterior crico-arytenoideus—we will observe in the mirror that the affected vocal cord during quiet respiration occupies almost the centre of the glottic opening. A deep inspiration which should be attended by a wide, outward swing of the cord is productive of no movement whatever. Phonation is not interfered with, but any exertion may occasion a slight dyspnœa.

A bilateral abductor paralysis with the two cords almost meeting in the middle line is accompanied by symptoms of much greater urgency. Respiration is quickened and usually noisy, and the least excitement or muscular activity on the part of the patient provokes an alarming dyspnœa. In the event that the cause of this double paralysis is not removable—and it usually is not—any delay in the performance of tracheotomy will expose the patient that much longer to the danger of sudden death.

Unilateral paralysis of the adductor muscle, the lateral crico-arytenoideus, alone is encountered with extreme rarity. The involvement of this muscle occurs, as a rule, only in total paralysees of the recurrent nerve.

When the paralysis of this nerve is complete we find that the cord occupies a position midway between that of respiration and the middle line of the glottis. This is the "cadaveric" position, and is a result of the complete inactivity of both the adductor and abductor muscles.

In phonation we find that the affected cord is perfectly quiet, while the other not only comes to but passes beyond the middle line in its endeavor to meet its fellow. In this exaggerated movement we see also that the arytenoid cartilage of the sound side advances in front of that of the affected side.

If the paralysis be bilateral both cords remain fixed in the cadaveric position.

The most noticeable symptom of unilateral recurrent paralysis is the vocal impairment. The voice is enfeebled and somewhat roughened; and while studying this symptom we may become conscious of another—the extravagant use of air in producing the voice. The incomplete closure of the glottis is responsible for this air-waste.

Complete aphonia will of course ensue upon a bilateral recurrent paralysis.

In the diagnosis of an apparent paralysis of this nerve we must exclude the existence of an ankylosis of the crico-arytenoid joint, and our success in doing this will be materially aided by a careful study of the history of the case, its manner of origin, and its subsequent course. We should acquaint ourselves with every systemic or local condition having a possible etiological bearing upon the case, and when we add to this information that derived from the inspection of the larynx we usually have enough with which to establish the diagnosis.

With the exception of those few cases dependent upon syphilis or upon some accessible and removable adenopathy, the prognosis of this disease is decidedly unfavorable.

Treatment. Treatment should comprise, first, the removal of the cause, and immediately afterward the employment of everything that will assist in restoring muscular energy. Local applications, the use of electrical stimulation, strychnine, and general tonics will all contribute to this end.

The functional adductor paralysis commonly known as “*hysterical aphonia*” is a purely psychical disability, the cure of

which depends rather upon general management of the patient than upon local medication of the larynx. It is to be recognized by the abruptness of its beginning and by the fact that involuntary acts such as coughing and laughing are phonic. Examination of the larynx will disclose perfect mobility of the cords, but an entire want of control over them. In selecting the treatment for each case the physician, after learning its history and ascertaining if possible the particular event or incident that has precipitated the attack, must decide whether sympathy or severity will be the more likely to re-establish normal will-power. Various surprises or shocks may be resorted to for tricking the patient into a momentary use of the voice, and these should be promptly reinforced by appeals to the common-sense of one case or an assault upon the fears of another.

Foreign Bodies.

The entrance of foreign bodies into the larynx is of very frequent occurrence. Unless they are inhaled during a deep inspiration when the glottis is at its widest, or unless they are of small size, they are usually arrested above the vocal cords. Violent convulsive cough is at once excited, or perhaps a spasm of the vocal cords sufficiently prolonged to occasion death or suffocation may be induced by the mechanical obstruction offered by the body itself. If, however, it has slipped past the cords and entered the trachea or one of the bronchi, the cough may quickly subside and a period of treacherous quietude ensue.

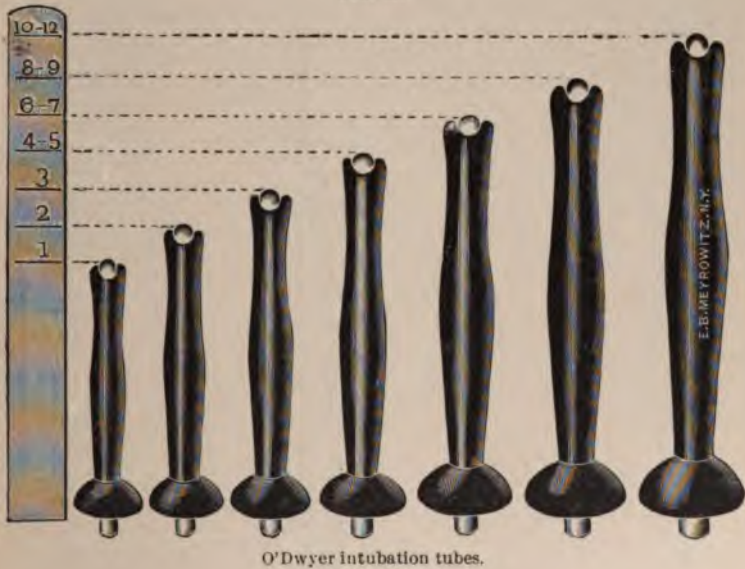
Removal of foreign bodies from the larynx through the natural passages is far from easy, and unless the necessary skill for doing this without inflicting additional injury is possessed, tracheotomy is the preferable means of affording relief.

In case the body has entered one of the bronchi a low tracheotomy should be performed, and instead of introducing a tube the wound should be kept open by sewing the edges of the tracheal incision to the skin.

Intubation.

This is a method of relieving dyspnœa due to various forms of laryngeal obstruction. The instruments now employed and the technique of the operation were all devised and perfected by the late Joseph O'Dwyer. Although it was intended primarily for that form of laryngeal obstruction due to the presence of an inflammatory membranous exudate, yet it has been successfully adopted in the treatment of several other varieties of acute or chronic stenosis of the larynx.

FIG. 81.



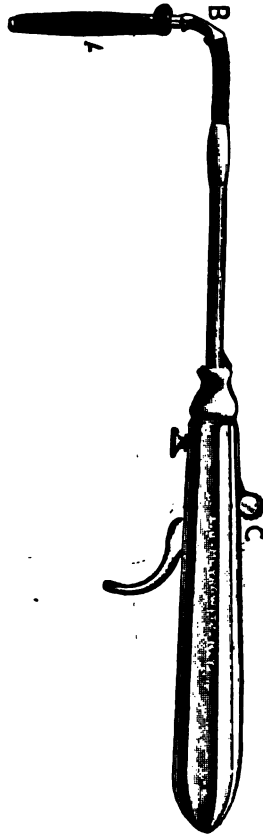
O'Dwyer intubation tubes.

The several instruments comprising an intubation set are shown in the accompanying illustrations. I shall not analyze the mechanical details of the tube, but only direct attention to the fact that each particular one of them makes it the better conform to some corresponding structural peculiarity of the larynx.

The set is usually composed of seven hard-rubber or gold-plated metal tubes (Fig. 81), varying in their dimensions accord-

ing to those of the larynges into which they are to be introduced. The figures upon the accompanying scale denote the ages to which the length of tube is adapted. An obturator is contained within each tube, and, projecting slightly beyond its lower end,

FIG. 82.



Intubator with a tube in the proper position for insertion into the larynx.

A, intubation tube; B, fork pushing tube away from obturator; C, knob, which when pushed forward causes the fork to strike the head of the intubation tube.

not only facilitates its introduction, but keeps the tube from becoming filled with secretion or portions of the exudate during its passage through the larynx. Through one side of the flange at the head of the tube is drilled a small hole, this being intended

for a silken loop, by which the tube can be rapidly extracted if necessary. The intubator (Fig. 82) is screwed into the obturator, and when the tube has been properly placed in the larynx a sliding fork releases it. A mouth-gag (Fig. 83) is another impor-

FIG. 83.



FIG. 84.



FIG. 83.—Mouth-gag.

FIG. 84.—Extubator: A, the jaws, partly open; B, lever, pressure on which in a downward direction opens the jaws; C, screw which regulates the extent to which the lever may be depressed and the jaws opened.

tant part of the outfit, and, finally, there is an extubator (Fig. 84), by which the removal of the tube is accomplished. The jaws seen at the extremity are introduced within the lumen of the tube closed, and are then opened by pressure upon the lever, B.

Sufficient purchase is thus given to easily lift the tube from the larynx.

His first few attempts at intubation are apt to bother more or less the most expert laryngologist ; but the difficulties connected with the operation are so quickly overcome that after a few repetitions even the general practitioner can perform it very creditably. It is quite a simple matter when the patient is a quiet adult with a chronic stenosis of some kind ; but when the patient is a child with a short, thick neck, struggling for breath, deeply cyanosed, and with the fauces filled with a thick exudate and a mass of viscid secretion, it is different. If, however, the operator is careful to have everything well arranged before he begins his work, and if he remains cool and collected throughout the operation, he will find that there are no obstacles that a little patience will not enable him to surmount.

In acute cases the indications for intubation are a severe and steadily increasing dyspnoea, exhaustion, and cyanosis, and evident retraction of the chest walls, particularly above and below the clavicles, during inspiration. To ensure perfect quiet on the part of the child it is snugly wrapped from its shoulders to below its feet in a folded sheet. The arms are pinioned close to the body, so that they cannot possibly escape and interrupt the later proceedings. An assistant, seated, holds the little patient in an almost erect position, with its legs grasped between his knees and its head resting on his left shoulder. The gag is introduced closed between the jaws on the left side of the mouth and then opened as widely as possible. A second assistant, standing behind the first, holds this gag and steadies the child's head. During the preparation of the child the operator has selected a tube of appropriate size, threaded it with a piece of suture silk, about a yard in length, and tied together the ends, and then replaced it upon the obturator that has been attached to the intubator. The little finger of the right hand, which holds the intubator, is hooked within the silken loop, and then the left fore-

finger enters the mouth, is passed back of the epiglottis, and proceeds downward and a little forward until its tip rests upon the eminences of the arytenoid cartilages. If these are not quickly found the finger had better be withdrawn, the child permitted a breath or two, and then re-introduced. When the finger-tip has finally located the arytenoids the handle of the intubator is held well down upon the patient's chest, while the tube points straight back into the mouth, exactly in the middle line. This line is strictly adhered to as the handle is raised and the tip of the tube passes backward and downward and is guided by the left finger into the glottic opening. Any deviation from this line is apt to send the tube to one or the other side of the laryngeal aperture and deposit it in the œsophagus. If, however, we have succeeded in entering the glottis, the finger-tip is transferred to the head of the tube, and as this is detached by the sliding fork of the intubator it is gently pushed downward until it is safely within the larynx, and is held there while the obturator is quickly withdrawn. The gag is removed and the loop of silk allowed to hang from the corner of the mouth for several minutes, until we are assured by the cough and the improved respiration that the tube is in proper position. The knotted ends of the loop may now be cut, and the finger, being once more carried to the head of the tube, holds it in place while the thread is withdrawn.

After a few deep, hungry inspirations the child's lids close, and he passes into a peaceful, life-giving slumber that should be filled with grateful dreams of O'Dwyer. As long as the tube remains in the larynx the feeding of the child may be a matter of some difficulty. Liquids are apt to enter the tube, and on reaching the trachea to excite violent coughing. This may be largely prevented by turning the child upon its face and so supporting it that the head is much lower than the rest of the body. In this position semisolids or even liquids may often be given without any invasion of the trachea. If this should be ineffective, however, we may maintain nutrition by means of a small

rubber catheter passed down into the stomach through the nose. In the event of this also being inexpedient or unsuccessful we must have recourse to the rectum.

The length of time that the tube shall remain in the larynx is governed altogether by circumstances. No arbitrary rule can be given for the settlement of this question. Very often, indeed, it is settled for us by the spontaneous expulsion of the tube at the end of three or four days. This is occasioned by the exfoliation of the membrane or the reduction of the swelling that have co-operated to prevent the escape of the tube. The average duration of its retention in cases that terminate favorably is probably four or five days. At the end of this time, if the child's condition offers no contraindication, we may remove the tube and observe for an hour or more the course of events. If the swelling and dyspnoea return there will of course be no delay in the reintroduction of the tube.

The method of its removal is practically identical with that of its introduction. The tip of the forefinger is carried to the head of the tube and the beak of the extubator guided by it into the mouth of its canal. Pressure upon the lever will then open the blades and render its extraction perfectly simple.

CHAPTER XIV.

THE EAR.

ANATOMY AND PHYSIOLOGY.

It is not proposed to give in this section a description of the anatomy of the ear that will do more than approach completeness. The more delicate anatomical features of the middle and internal portions of the ear should be obtained from those volumes that are devoted exclusively to the study of this organ. I shall introduce here only so much anatomy as will be essential to a clear comprehension of the symptoms and pathology of the diseases that are to be considered. Nothing will so smooth the pathway of the student of aural disorders as an intimate familiarity with the anatomy of the organ. A knowledge of the relation of its different portions to one another, to the cranial cavity, and to the neighboring vessels and nerves will often give valuable pathological and therapeutical significance to symptoms that might otherwise be quite thrown away upon us. It has long since become an established custom to describe the organ of hearing as consisting of three portions—the *external*, *middle*, and *internal*. This division may not be accurate from a developmental point of view, but it has practical advantages that quite suffice to justify it.

External Portion of the Ear.

The Pinna or Auricle. This is the most external portion of the ear, and is attached to the side of the skull in the fossa between the mastoid process and the ramus of the jaw. It has an anterior and a posterior surface, and the former presents a

series of ridges with intervening depressions to which there are corresponding irregularities on the posterior surface.

The more prominent features of the anterior surface are the *crista helicis*, which runs horizontally forward just above the opening of the external auditory canal, and terminates in front by passing upward into the curved outer border of the pinna called the *helix*. In front of this scroll-like border is another elevation running parallel with it for some little distance, and terminating

FIG. 85.



Auricle. (POLITZER.)

A. Helix. B. Antihelix. C. Tragus. D. Antitragus. E. Lobule. F. Concha.
G. Orifice of the external meatus.

above in two diverging extremities (*crura furcata*), and below in the *antitragus*.

Between the helix and the antihelix there is a depression called the *scaphoid fossa*, while the space between the *crura furcata* is known as the *fossa intercruralis*.

The *concha* is the deep cavity embraced by the antihelix. It is the vestibule which leads to the entrance of the external auditory canal. Projecting outward over the anterior margin of this opening is the *tragus*, while below and behind it is the *antitragus*. The pinna terminates below in the *lobe*.

The general form and surface markings of the auricle are derived from the cartilage which is the basis of the structure. It is of the yellow or reticular variety, and has an average thickness of about 2 mm. The lower extremity of the pinna, the lobe, consists of connective tissue and fat enveloped by an integument that is somewhat thicker than that covering the other portions of the auricle. There are a few sebaceous glands in the lobe and in the fossa intercruralis, but they are in much greater number in the concha. The cartilage is covered by perichondrium, and to this is attached several muscles that have a purely anatomical rather than a practical interest. They are the *tragicus*, *antitragicus*, *helicis minor* and *major* on the anterior surface, and the *transversus auriculæ* and *obliquus auriculæ* on the posterior surface. They are all rudimentary in man and frequently atrophy to such a degree that they can scarcely be detected.

The muscles which move the auricle as a whole are :

1. The *attollens auriculæ*, which takes its origin from the temporal fascia, and is inserted into the posterior surface of the cartilage. This supports and pulls the pinna upward.
2. The *attrahens auriculæ*, also arising from the temporal fascia and passing to the crista helices. Its contraction draws the auricle forward and upward.
3. The *retrahens auriculæ*, which has its origin in the mastoid process and is attached to the posterior convex surface of the cartilage. This muscle draws the auricle backward, but the amount of movement communicated to the cartilage by these muscles is in the majority of cases almost imperceptible.

External Auditory Canal. This canal consists of a *cartilaginous* and an *osseous* portion. Its total length is about an inch and a quarter, one-third of this being cartilaginous and the remainder bony. It is not a straight tube, its two portions meeting one another at an obtuse angle which opens downward and forward. The point of junction of its two portions is, therefore, the highest

part of the canal. This angular curvature is apt to add very materially to the difficulties of examining the membrana tympani. A transverse section of the tube shows it to be elliptical, the longer diameter being vertical.

The outer or cartilaginous portion of the canal is formed by a continuation inward of the auricular cartilage. The tube is not perfect, however, for at its inner extremity there is a wide gap in the upper and posterior wall. This is filled in by a fibrous

FIG. 86.



Vertical section of the external auditory canal, membrana tympani, and tympanic cavity, viewed in front. (POLITZER.)

a. Upper osseous wall of the canal. n. Lower osseous wall of the same. b. Tegmen tympani. c. Osseous floor of the tympanic cavity. d. Tympanic cavity. e. Membrana tympani. f. Head of the malleus. g. Lower end of the handle of the malleus. o. Short process of the malleus. h. Body of the incus. i. Stapes in the oval window. k. Fallopian canal. l. Jugular fossa. m. Glandular orifice in the skin of the cartilaginous canal.

membrane, which is really a portion of that which connects the two divisions of the canal.

The cartilaginous portion of the canal is composed, at birth, of two or three segments, and the incomplete union of these in later life gives rise to two or more fissures, usually situated in the antero-inferior portion of the canal and running transverse to its long axis. These are known as the *incisuræ Santorini*, and are filled in with fibrous tissue. Their importance is derived from

the fact that they give the canal more or less flexibility, which permits of its being straightened, and also that they facilitate the extension of inflammation either from within the canal outward, or *vice versa*.

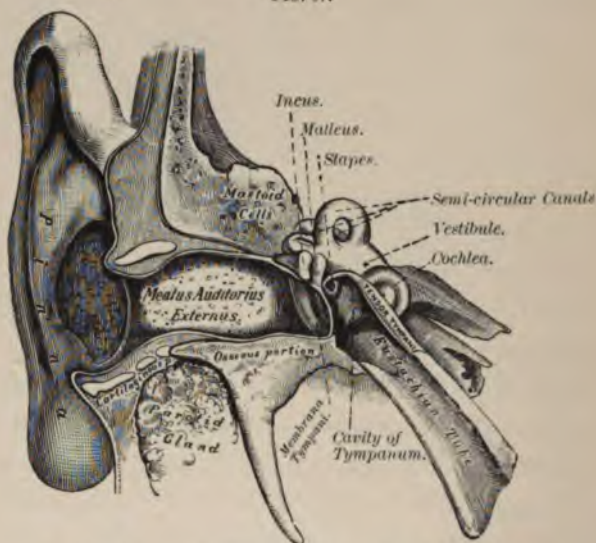
Osseous Portion. This portion of the canal is developed from what in the child is known as the *annulus tympanicus* or tympanic ring. This ring is attached to the squamous and petromastoid portions of the temporal bone. It is incomplete above, but its extremities reach upward to the outer plate of the horizontal portion of the squama, and it is through the union and subsequent development of these structures that we have formed the osseous part of the external auditory canal. It comprises about two-thirds of the entire length of the canal, and its usual length is about three-quarters of an inch. Not infrequently in the adult bone we find fissures in the upper and posterior walls of this bony canal. These being filled in with connective tissue, it is easily conceivable how inflammation in their vicinity can be transmitted to the periosteum and bone, and lead perhaps to caries of the canal walls.

The canal is lined throughout by a prolongation inward of the integument covering the auricle. In the cartilaginous portion of the canal it resembles ordinary skin, but in the osseous portion it becomes much thinner and so altered in color that it is difficult to distinguish it from mucous membrane. With the exception of the color, however, it retains all the characteristics of the skin, and we will find that the diseases affecting it are those of the skin and not those of the mucous membranes. A firm subcutaneous tissue lies between this integumentary lining and the perichondrium and periosteum, which are found respectively in the outer and inner portions of the canal.

The cutis within the canal presents a more or less abundant growth of hair, principally in the cartilaginous portion, and in connection with these hairs there is a proportionate number of sebaceous glands. The ceruminous glands begin immediately

within the orifice of the canal and extend almost to the circumference of the membrana tympani. They are in greatest number at the point of junction of the two portions of the canal, and their total number has been variously estimated at from one thousand to two thousand. The cerumen secreted by these glands is, when in fresh condition, nearly fluid and of a bright yellow color. After exposure to the air for a time the color darkens considerably and the consistence becomes firmer.

FIG. 87.



A front view of the organ of hearing (right side). (GRAY.)

The arteries supplying the pinna and the outer portion of the external meatus come from the temporal and the internal maxillary arteries. Three or four branches spring from the temporal and supply the helix, the lobe, the tragus, and concha. Smaller branches pass inward along the floor of the canal and terminate in the cartilaginous portion. The posterior surface of the pinna is supplied by branches from the posterior auricular artery. Some of the smaller twigs perforate the cartilage and anastomose with the vessels on the anterior surface.

The principal artery of the canal is the deep auricular artery, a branch of the internal maxillary. It perforates the anterior wall of the canal, supplies both its osseous and cartilaginous portions, and terminates in a comparatively large branch upon the *membrana tympani*.

The vessels distributed upon the drum-membrane come from two sources. The deep auricular artery just mentioned is one, the tympanic artery the other. The latter is a branch of the stylomastoid artery. It receives several small branches from the deep auricular, makes its way into the tympanic cavity through the Glaserian fissure, and forms a fine vascular network in the mucous layer of the *membrana*. The terminal branch of the deep auricular ramifies in the external or cutaneous layer of the *membrana*. There is no anastomotic communication between these two sets of vessels except at the circumference of the membrane. The median layer of the membrane—the *membrana propria*—is non-vascular.

The external layer has much the richer vascular supply. A large vessel descends from the upper margin of the membrane and passes down in close proximity to the handle of the malleus toward the centre. In its course it gives off a number of radiating branches, and finally breaks up into a plexus about the tip of the manubrium. The vessels of the internal or mucous layer are much finer, and they form a very delicate capillary network.

The venous drainage of the two surfaces of the auricle is accomplished through the several auricular veins which empty into the temporal vein and ultimately into the external jugular.

The lymph vessels of the external portion of the ear are traced into the subauricular glands, which are found near the mastoid process, and some of them also empty into the superficial facial glands which are in proximity to the parotid.

The nerve-supply of the external portion of the ear is derived from

1. The cervical plexus, through the auricularis magnus, which ramifies in the skin in the anterior surface of the auricle.

2. The facial, which supplies by means of the deep posterior auricular nerve the posterior surface of the auricle.

3. The vagus, supplying the lower part of the anterior surface of the pinna and the cartilaginous portion of the external auditory canal.

4. The trigeminus, its third division giving off the auriculo-temporal nerve. Two branches come from this, one of which is distributed in the integument lining the cartilaginous portion of the auditory canal, while the other not only supplies the canal, but sends branches to the tympanic membrane.

Middle Portion of the Ear.

This consists of the tympanic cavity, the Eustachian tube, the ossicles, and the mastoid cells.

The shape of the tympanum is conspicuous for its irregularity. It has been compared to a hollow cube, the walls of which are of unequal size and very different in shape. The description of the cavity is much facilitated by ascribing to it a roof and floor, and external, internal, anterior, and posterior walls.

The greater portion of the roof is formed by the *tegmen tympani*. It is arched somewhat, with its concavity facing downward, and is completed by the horizontal part of the squama.

The floor is chiefly composed of the *fundus tympani*, a lamella of bone which projects from the lateral inferior surface of the petrous bone. The anterior portion of it assists in forming the posterior wall of the carotid canal. Its upper surface, the floor of the tympanum, is very irregular, and is traversed by a number of thin, vertical, bony plates that give it a cellular appearance.

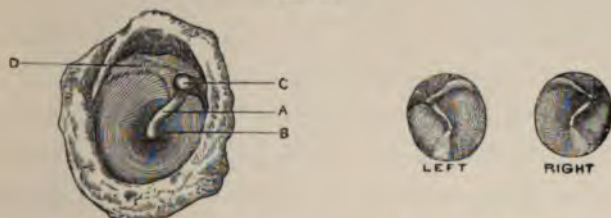
The anterior wall is notable for the entrance, at its upper part, of the Eustachian tube.

The posterior wall is mainly composed of the sheath of bone enveloping the Fallopian canal, and enclosing, also, the *stapedius*

muscle. In its upper portion is the opening which leads to the mastoid cells (*antrum mastoideum*).

The outer wall is made up entirely of the *membrana tympani* and the osseous frame—the *annulus tympanicus*—upon which it is stretched. This membrane is slightly elliptical, its longer, vertical diameter being from 9 to 10 mm., its shorter, transverse, from 8 to 9 mm. Its attachment to the tympanic ring is in a groove (*sulcus tympanicus*), but this groove ends at the junction of the ring with the horizontal portion of the squama. Throughout childhood the tympanic membrane is not far from being horizontal, but with the further development of the temporal bone it

FIG. 88.



View of the outer surface of membrana tympani.
(GRUBER.)

The normal membrana tympani.

A. Malleus; manubrium. C. Short process. B. The tip of the manubrium. D. Posterior fold.

gradually becomes more vertical. Even at the completion of development, however, the vertical diameter always forms an obtuse angle with the roof and the posterior wall of the canal and an acute angle with its floor and anterior wall.

The outer surface of the membrane is concave, the point of greatest concavity being at about the centre of the membrane (*i. e.*, at the lower extremity of the handle of the malleus). This point is termed the *navel* or *umbo*. The upper extremity of the handle of the malleus—the *short process*—projects further outward than the lower extremity, and hence the membrane is more prominent at this point than lower. As a consequence of this two folds are found in the drumhead—one in front of and the

other behind the short process, the latter being the more prominent. "Pearl gray" is the term most frequently used in describing the color of the normal membrana tympani, but it should be remembered that this is susceptible of considerable variation, and that various qualifying tints may be given to it by the neighboring structures.

In studying the structure of the membrane we recognize three distinct layers: (1) An external, integumentary layer; (2) a middle, fibrous layer; (3) an internal, mucous layer. Of these the first and third are merely continuations of the linings of the external auditory canal and the middle ear. They add very little strength to the membrane, and are principally of value as supporting structures for the bloodvessels and nerves.

The middle or fibrous layer of the membrane is of much firmer material than the two between which it is placed. Histologically, it is found to consist of two strata: (1) The external or radiating-fibre layer; (2) the internal or circular fibre layer. The fibres of the external layer are so arranged as to radiate from the centre to the circumference, and it is, therefore, called the radial layer. Above the short process of the malleus a small, triangular portion of the membrane is found in which these radiating fibres are entirely wanting. The general arrangement of the fibres in the internal layer is circular, and this gives it the name of the circular layer. They are not evenly distributed, being more numerous in certain areas than in others, and they are particularly scanty in that same triangular section from which the radiating fibres are absent.

On attempting to separate the tympanic membrane from the handle of the malleus it will be found that the lower two-thirds of the bone are firmly embedded in the membrane and are detached with some difficulty. Nearer the circumference, however, in the vicinity of the short process, the attachment is much looser, and the two structures can be disengaged quite readily. The absence from this region also of the fibres of the middle

layer emphasize its thinness and looseness, and hence it was named by Odo Shrapnell the *membrana flaccida*. Its extent varies somewhat, and in it is found the so-called *foramen Rivini*. This consists of one or two small perforations in the membrane situated either above the short process or in front of or behind it. Opinion is still divided as to whether these openings are anatomically normal or whether they are the result of middle-ear inflammation.

The inner wall of the tympanum bears a considerable number of important and interesting features. Passing from above downward we observe first a bony projection running antero-posteriorly which denotes the position of the Fallopian canal. Below this ridge is the *fenestra ovalis*, which contains the foot-plate of the stapes. It measures 3 mm. in length and 1.5 mm. in breadth, and its long axis is directed downward and backward. It leads into the vestibule of the labyrinth. Behind this oval opening is found a small bony projection, the *eminentia pyramidalis*. The apex of this, directed forward, contains an opening which leads to a downward curving canal, 8 to 10 mm. long. This canal is for the lodgement of the *musculus stapedius*, the tendon of which emerges through the opening in the apex of the *eminentia pyramidalis*, and is attached to the adjacent head of the stapes.

Below the *fenestra ovalis* lies the *promontory*, a bony projection which marks the location of the cochlear canals, and which occupies much the greater portion of the inner wall of the tympanum.

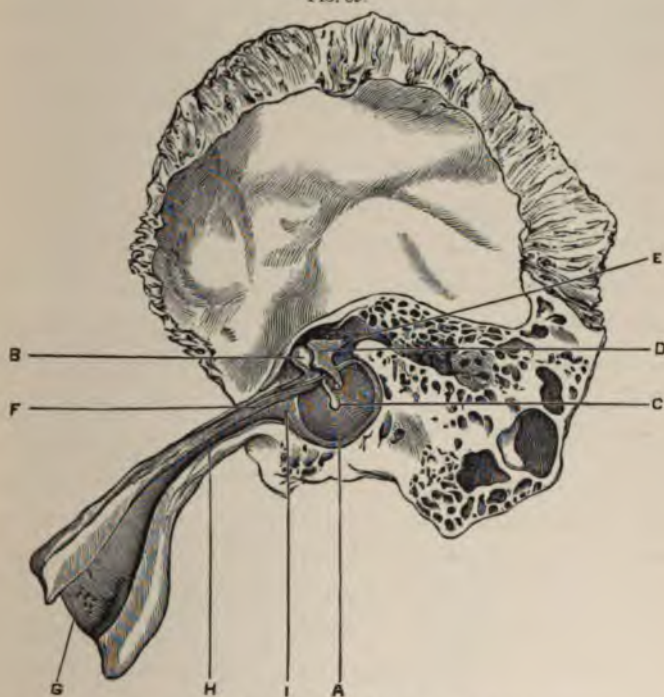
At the lower and posterior border of the promontory is found the depression at the bottom of which is the *foramen rotundum*.

The Eustachian Tube. This is the channel of communication between the nasopharynx and the cavity of the tympanum. Its structure bears a close analogy to that of the external auditory canal. It is an angular tube, like the latter, and is made up of an osseous and a cartilaginous portion. It is at the junction of these two portions that the angle occurs. Its two openings are known respectively as the tympanic and the pharyngeal orifice,

and their relative position is such that the former is situated somewhat above and posterior to the latter. The bony part of the tube passes from the upper part of the anterior wall of the tympanum forward and downward. Its lumen is somewhat triangular and becomes narrower as it proceeds, until it is most contracted at its point of junction with the cartilaginous portion. This latter part of the canal is not formed of a complete tube of cartilage, but two plates—a median and a lateral—which by their union form a scroll-like structure. The median is much broader than the lateral, and, being attached to the base of the skull, is fixed, while the lateral plate is movable. This tubal cartilage expands as it approaches the pharynx, and is widest at its opening into this space. The membranous part of the tube is that which fills in the defect in the cartilaginous wall. This is in the anterior and lower part. The palatal muscles arise in part from this membranous portion of the tube. The mucous membrane lining the Eustachian tube is a continuation of that lining the nasopharynx. As it approaches the tympanic cavity it becomes much thinner, its glands fewer, and its submucous tissue less abundant. Its general structure is identical with that which lines the nasopharynx, its epithelium being of the ciliated, cylindrical variety. Several longitudinal folds traverse the membranous portion of the tube, and these permit of its easy dilatation. Its glands are abundant at the pharyngeal orifice, but are in greatest number about its middle portion. They are acinous. The movement of the cilia is directed from the tympanic to the pharyngeal orifice. At the lower opening of the tube its lumen appears as a narrow fissure, the opposing surfaces of the mucous membrane being in contact or very slightly separated. The Eustachian tube of the child differs in several respects from that of the adult. It is wider in its entirety, the osseous portion is relatively much shorter than in the adult, the angular curvature is less, and, therefore, the tube is more nearly horizontal. It is to be observed, also, that the pharyngeal orifice is less gaping than in

the adult, and that its projection from the lateral wall of the pharynx is less marked. Finally, in the child the membranous portion of the tube is relatively greatly in excess of the cartilaginous, and, in consequence, the tube can be much more easily expanded. Although the question as to whether it is normal for the tube, when in repose, to be closed or open is still occasionally

FIG. 89.



Eustachian tube and tympanic cavity. (POLITZER.)

A. Membrana tympani. B. Head of the malleus. C. Lower end of the handle of the malleus. D. Body of the incus. E. Short process of the incus. F. Tensor tympani muscle. G. Pharyngeal opening of the tube. H. Isthmus of the tube. I. Tympanic opening of the tube. (Right side.)

discussed, the preponderance of reasoning seems to be in favor of the belief that it is closed. A question of much greater practical importance is as to the firmness of this closure with reference to the amount of force that must be employed for the artificial inflation of the tympanum. There can be no such thing as a standard

for comparison in this matter. Individual variations within the limits of perfectly normal audition are too wide to permit of it.

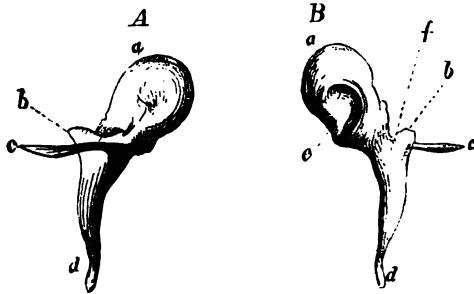
The muscles that effect the opening of the tube during the act of swallowing are the *tensor palati* and the *levator palati*. The *tensor palati* has its origin from the under surface of the sphenoid process, the membranous wall of the cartilaginous portion of the tube, and from the lower extremity of the tubal cartilage itself. It passes downward and around the hamular process of the pterygoid plate, and then spreads itself, fan-like, through the substance of the fibrous portion of the palate. The firm attachment of its tendon to the hamular process enables the muscle to exert a much greater action upon the Eustachian tube when it contracts than upon the soft palate. The effect of its contraction upon the tube is to draw the membranous wall, including the hook of the tubal cartilage, away from the inner wall, and so to permit air to enter the tympanum or secretion to escape from it. So exclusively does this muscle act upon the tube that it is widely known as the *abductor tubæ* muscle. The *levator palati* originates upon the under surface of the petrous part of the temporal bone, adjoining the carotid canal. As it passes downward from this point parallel to the Eustachian tube it becomes attached by means of a number of connective-tissue fibres to the membranous floor of the tube as well as to the cartilaginous plate. In its further course the muscle becomes flattened and is inserted, by a broad tendon, partly into the fibrous margin of the hard palate and partly into the soft palate below the pharyngeal opening of the tube. The contraction of this muscle increases the transverse diameter of the tube by pulling its lower wall upward and backward.

The Ossicles. The *malleus* or hammer: this bone presents a head (*capitulum*), a neck (*cervix*), and a handle (*manubrium*).

The head is the highest and largest of the three portions, and when the ossicle is *in situ* is quite hidden from view in the space above the upper margin of the *membrana tympani*. The facet

for articulation with the body of the incus is found upon its posterior surface. The neck is short and flattened, and its junction with the handle makes quite an obtuse angle. The short process seems to be no more than a continuation upward of the handle beyond the neck.

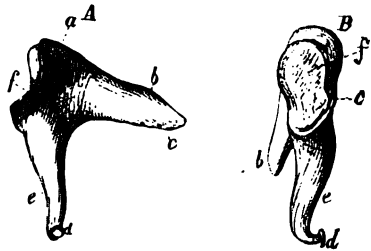
FIG. 90.



Right malleus. *A*. From in front. *B*. From behind, magnified 4 diam. (HENLE). *a*, head; *b*, short process; *c*, long process; *d*, manubrium; *e*, articular surface; *f*, the neck.

The *incus* or anvil bears a striking resemblance to a molar tooth. It has a body or crown and a long and a short process. The articulating surface on the body presents forward to meet the head of the malleus. The short process is approximately

FIG. 91.



Right incus, magnified 4 diam. (HENLE). *A*. Inner surface. *B*. View in front. *A* *a* and *B* *c*, body; *b*, short process; *c*, long process; *d*, processus lenticularis; *f*, articular surface for the head of the malleus; *e*, surface which lies in contact with wall of tympanic cavity.

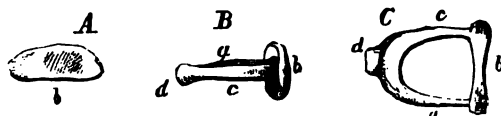
horizontal, and its tip is directed backward toward the mastoid antrum, to the lower angle of which it is attached by a fan-shaped ligament. The long process extends almost perpendicularly downward from the body, forming nearly a right angle with

the short process. Its tip curves inward for articulation with the head of the stapes.

The *stapes*, as its name implies, is in shape very much like a stirrup. Its component parts are a foot-plate, two crura, and a head. The foot-plate is kidney-shaped, and is held in the foramen ovale by the annular ligament. The two crura form an arch, at the apex of which is the head of the stapes. On the posterior surface of this there is a slightly roughened spot, to which is attached the tendon of the stapedius muscle.

The articular surfaces of the malleus and incus are covered by thin layers of cartilage, and in the joint formed by the two there is an interarticular cartilage. The tip of the long process of the incus is covered with cartilage, and articulates with the head of

FIG. 92.



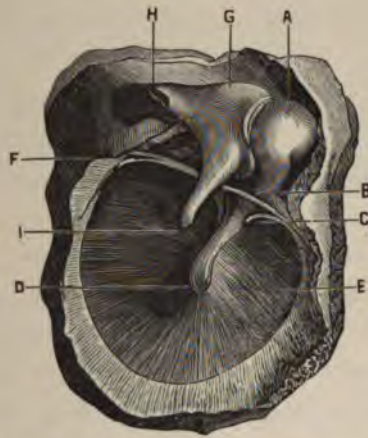
Right stapes, magnified 4 diam. (HENLE). A. From within. B. From in front. C. From beneath. b, foot-plate or base; d, capitulum; c, anterior; a, posterior shaft, or crus of stapes.

the stapes by an almost socket-like joint. Their connection is effected by a fibrous capsular ligament.

The articulated upper extremities of the malleus and incus are situated above the superior margin of the membrana tympani, in the external part of the roof of the tympanum—that portion known as the *recessus tympanicus*. The ossicles are attached to the walls of the tympanum by a number of ligaments. The suspensory ligament connects the head of the malleus with the roof of the cavity, and from the long process of the malleus the anterior ligament passes to the Glaserian fissure. The horizontal process of the incus articulates by its extremity, covered with cartilage, with a shallow, cartilaginous surface upon the posterior wall of the tympanum. The mucous membrane lining the tympanum is a continuation of that which ascends the *Eustachian*

tube from the nasopharynx. It lines not only the tympanum itself throughout, but envelopes also the different structures which the tympanum contains. It is an extremely delicate membrane, covered partially by pavement, partially by ciliated epithelium. It passes back also into the mastoid process, and forms the mucoperiosteal lining of the air cells. The intratympanic muscles are the tensor tympani and the stapedius. The tensor tympani arises from the cartilaginous portion of the Eustachian

FIG. 93.



Internal surface of the left membrana tympani (enlarged). (POLITZER.)

A. Head of the malleus. B. Neck of the malleus. C. Tendon of the tensor tympani muscle and anterior fold of the membrana tympani. D. Inferior extremity of the handle of the malleus. E. Anterior portion of the membrana tympani. F. Posterior fold of the membrana tympani and chorda tympani. G. Incus. H. Short process of incus. I. Long process of incus.

tube, from the adjacent portion of the great wing of the sphenoid, and from the bony canal through which it passes. Upon reaching the end of this canal its tendon curves around a bony process—the *processus cochleariformis*—in order to reach the outer wall of the tympanum, and it is inserted into the inner and anterior surface of the handle of the malleus. It is well to remember that the tendon passes outward almost at a right angle from the body of the muscle, crossing from the inner to the outer wall of the cavity.

The stapedius muscle has its origin from the bony canal that is situated just internal to the descending portion of the Fallopian canal, and it makes its entrance into the tympanum through the little opening at the summit of the eminentia pyramidalis. Its delicate tendon is inserted into the head of the stapes, and partly also, it is asserted, into the lower extremity of the descending process of the incus. The contraction of the muscle raises the anterior part of the foot-plate of the stapes out of the oval window. Politzer has demonstrated that the tensor tympani is supplied by the motor portion of the fifth nerve, and that the central fibres of the stapedius muscle are under the control of the facial nerve.

The arteries supplying the middle ear include :

1. Small branches from the ascending pharyngeal, which supply the Eustachian tube and reach also the tympanic mucous membrane.

2. The stylomastoid artery, a branch of the posterior auricular, gives off, in its passage through the Fallopian canal, several small branches which enter the tympanum. It also sends some twigs to the mucoperiosteum of the mastoid cells and to the stapedius muscle.

3. The middle meningeal, a branch of the internal maxillary, sends some branches to the Eustachian tube, and other branches supply the roof of the tympanum and the promontory.

4. Some small branches from the temporal artery enter the cavity of the tympanum by way of the Glaserian fissure.

The venous drainage of the ear is effected by veins which accompany the arteries and which empty their contents into the venous plexuses near the temporomaxillary joint into the veins of the pharynx and also into the middle meningeal veins.

The lymphatic vessels of the tympanic cavity terminate in the anterior and posterior auricular glands, and a large portion of them also in the lymphatic glands of the pharynx.

The nervous supply of the middle ear is derived from the fifth, seventh, and ninth cranial nerves and from the sympathetic. In

detail, we find that the otic ganglion provides for the Eustachian tube and the tensor tympani muscle; the facial supplies the stapedius muscle; and the glosso-pharyngeal, through the branch from its petrosal ganglion—the tympanic or Jacobson's nerve—supplies the mucous membrane of the tympanum. The tympanic plexus is found upon the inner wall of the middle ear, and is composed of the tympanic nerve which passes through the floor of the tympanum to the promontory, filaments from the sympathetic coming from the carotid plexus, and the small superficial petrosal nerve. This plexus distributes branches to both the oval and round windows and to the lining membrane of the middle ear and Eustachian tube.

The Mastoid Process. This process does not make its appearance until about the end of the first year. At birth it consists of only a small, undeveloped tuberosity, and of cells there is but one, the antrum. Its growth is marked by its extension downward, and by the end of the fifth year it closely resembles that of the adult in the general arrangement of its cells and the relative thickness of its walls. It differs only in that it is smaller and in the less density of its bony substance. In the adult this process is somewhat conical in shape, its tip pointing downward. It is usually more or less flattened from without inward, and upon its inner surface will be found a deep groove in which is fixed the posterior belly of the digastric muscle. The external surface of the mastoid is frequently much roughened, and it is a common happening for it to show, particularly posteriorly, the openings of a number of little channels which lead into the cellular portion of the structure. It will be readily perceived how easy it is for any inflammatory material within the mastoid to make its way outward through these canals, and to make its way backward perhaps into the occipital region or else downward into the cervical tissues.

When the external wall is very thin one or more of the cells may be exposed, and in such cases subcutaneous emphysema

upon forcible inflation of the middle ear is an occurrence of some frequency.

The growth of the mastoid is accompanied by the development of its cellular spaces. We know from the numerous anatomical investigations that have been made that in respect of the cellular structure no two mastoid processes are alike. Zuckerkandl's examination of some two hundred and fifty specimens led to his finding that in 20 per cent. of them there were no air cavities, 38.6 per cent. were completely pneumatic, while the others were more or less diploëtic. The variations that exist are extremely wide, and no definite or safe conclusion can be formed as to the character of any particular process by inspection, palpation, or percussion. The cells are occasionally so large that at times a single one will represent the entire cavity. The central cells are usually the largest, and communicate with one another more or less freely. In quite a number of instances the cellular spaces extend into the temporal bone, about the lateral sinus or backward toward the occipital suture, and accompanying the development of the internally placed cells there is a gradual thinning of the wall of the bone which separates them from the sigmoid sinus. In the pneumatic type of mastoid there is a varying number of cells that communicate not only with the antrum, but with one another. They all contain air, and are lined by a continuation of the mucous membrane that is found in the tympanum, the epithelium being non-ciliated. The roof of the antrum is a very thin lamina of bone, serving as a barrier between it and the dura mater. The lateral sinus also is but thinly separated from the cells of the mastoid, its groove sinking into the inner wall of the process. If we recall the downward passage of the facial nerve through the mastoid cells after it has coursed along the upper portion of the tympanic wall we will realize the ease with which it may become involved in inflammations of the mastoid cells or perhaps injured during operations upon this process. Not infrequently pus burrows its way

down to the very tip of the mastoid, perforates its thin inner wall, and escapes into the muscles and deep fascia of the neck. The proneness of the lateral sinus to depart from its usual course should make us always cautious while operating anywhere in its neighborhood.

The Internal Ear.

The inner ear constitutes the perceptive portion of the auditory organ, and contains the structures that are affected by the sound waves. It consists of the bony and membranous labyrinth, and includes also the origin and trunk of the auditory nerve.

FIG. 94.



External view of a cast of the left labyrinth. (HENLE.)

f. Fenestra cochleæ, or round window. *a.* Fenestra vestibuli, or oval window. *b.* Ampulla of superior semicircular canal. *e.* Ampulla of posterior semicircular canal. *d.* Common shaft of union of these two canals. *c.* Ampulla of the horizontal semicircular canal. *g.* Tractus spiralis foraminosus.

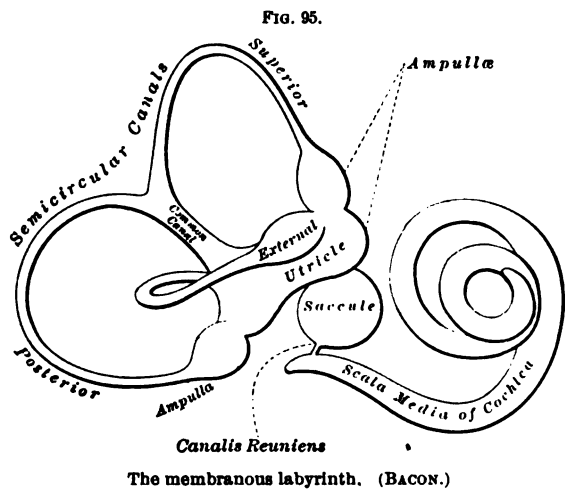
The Labyrinth. This is an osseous chamber that is distinctly differentiated by certain structural peculiarities from the bony substance surrounding it. It contains within it a membranous labyrinth, and is divided into (1) the vestibule, (2) the semicircular canals, and (3) the cochlea. (Fig. 94.)

1. The *vestibule* is placed immediately internal to the inner wall of the tympanum. It lies between the cochlea and the semicircular canals, the former being in front of and the latter behind it. It is the common chamber of communication of the different portions of the bony labyrinth with one another. In shape it is oval or elliptical. Upon its external wall is found the

fenestra ovalis, this being closed by the foot-plate of the stapes. The annular ligament serves to hold this latter in position. At the anterior part of the inner wall is the *recessus hemisphericus*—a small depression which presents a number of minute perforations through which enter the filaments of the vestibular nerve. Behind this is a ridge called the *crista vestibuli*. Still further posteriorly is situated the opening of the *aqueductus vestibuli*, which gives passage to a small vein. It is believed by some investigators that this canal contains a tubular prolongation of the lining membrane of the vestibule, and that this terminates in a cul-de-sac between the layers of the dura mater. Another opening in the vestibule is one which leads to the scala vestibuli of the cochlea, and which, therefore, is termed the *apertura scalæ vestibuli cochlear*. It is on the anterior wall of the vestibule beneath the recessus hemisphericus, while in the floor just beneath the fenestra ovalis there is a fissure through which the vestibule communicates with the fenestra rotunda.

2. The *semicircular canals*, three in number and each forming more than a half-circle, open into the posterior part of the vestibule by four orifices. They lie in three planes, almost perpendicular to one another, and have been named the superior, posterior, and inferior, from their relationship to the petrous portion of the temporal. Strictly speaking, however, they do not occupy these relative positions, and Retzius has better named them the anterior, external, and posterior. The anterior, or superior, is almost vertical, and lies transversely to the long axis of the petrous bone. The posterior is directed backward, is also vertical, and lies more or less parallel with the posterior wall of the petrous bone. The external, or inferior, is the shortest of the three, extends in an outward or backward direction, and is nearly parallel with the under surface of the petrous. One extremity of each canal is dilated near its point of opening into the vestibule, and this portion, almost twice the diameter of the rest of the canal, is known as the *ampulla*. The ampullar dilatations of the

anterior and external canals unite and open by a common orifice into the upper and anterior portion of the vestibule, while that of the posterior canal makes its entrance into the lower and back part of the vestibule. Of the undilated extremities, the posterior end of the superior canal and the upper end of the posterior canal unite and enter the vestibule by a common opening, while the posterior end of the external canal has an independent opening. It is as a result of this series of combinations that the six crura of the semicircular canals enter the vestibule by but four openings. (Fig. 95.)



3. *The Cochlea.* The canal of this portion of the labyrinth has its origin at the anterior inferior part of the vestibule. It is coiled about an almost horizontally placed axis—the *modiolus*—making two and a half turns, and, owing to its gradually diminishing calibre, gives the cochlea a conical shape. The base of this cone is directed backward and inward toward the internal auditory canal, and its apex forward and outward toward the tympanic cavity. There are several minute foramina in the base which give entrance to the cochlear branch of the auditory nerve. On laying open the cochlear canal throughout its length it is

covered that bony laminae project toward the centre of the tube from both its inner and outer walls. These—the *lamina spirales osseae*—approach, but do not meet one another, the interval between them being bridged by the *lamina spirales membranacea*. The cochlear canal is thus divided into two passages, the one lying above the other. Of these the superior is termed the *scala vestibuli*, because it opens into the vestibule; the inferior the *scala tympani*, because it is in communication with the tympanum through the medium of the fenestra rotunda. The lamina spiralis ossea terminates at the apex of the cochlea in a sickle-shaped process, the *hamulus*. Between the convex border of this process



The cochlea laid open (enlarged). (GRAY.)

and the cochlear wall is stretched a membrane which cuts off a portion of the scala vestibuli and forms the *scala media* or *ductus cochlearis*. Between the concave border of the hamulus and the extremity of the modiolus there is an opening—the *helicotrema*—by means of which the *scalæ tympani* and *vestibuli* communicate with one another. (Fig. 96.)

Two canals of some size make their way through the bony axis of the cochlea. One—the *canalis centralis modioli*—passes from the base to the cupola, where it ends, either in a single large opening or in a thin plate of bone with a number of perforations in it. The other canal is the *canalis spiralis modioli*. It follows the line of attachment between the bony lamina and the modi-

olus, is of irregular lumen, and is divided by a septum into two passages, an upper and a lower. The walls of this spiral canal present many minute perforations, through which there pass into it vessels and nerves from the central canal, and out of it vessels and nerve fibres which pass between the two plates of the bony lamina. The lower passage of the spiral canal contains a swelling of the cochlear nerve—the *ganglion spirale*—and through this the nerve filaments pass on their way to the lamina spiralis. In the upper passage is found a small vein.

The aqueductus vestibuli has its origin in front of the common opening of the superior and posterior semicircular canals. It passes upward for some little distance, and then turning downward terminates upon the posterior surface of the petrous bone.

The orifice of the aqueductus cochleæ is found upon the basilar surface of the petrous bone and leads to a canal, transmitting a small vein, which ends upon the floor of the scala tympani.

The Membranous Labyrinth. The membranous structures of the labyrinth do not completely fill the chambers of the bony labyrinth, and in the interval thus left between their walls we find a fluid called the *perilymph* in contradistinction to a fluid found within the membranous labyrinth which has been called the *endolymph*.

The membranous structures contained within the vestibule consist of two small sacs, the *utricle* and the *sacculus*. The former of these is, in its anatomical relations, an appendage of the membranous semicircular canals, while the latter bears a similar relation to the membranous contents of the cochlea.

The *utricle* is placed behind and somewhat above the *sacculus*. It is elliptical in shape, and into it open the three membranous canals. It is attached at one point to the *sacculus* and at another to the wall of the bony vestibule. Its structure is that of a fibrous membrane with an internal lining of epithelium, and this latter, at the point of attachment to the bony wall, is

modified for the reception of the nerve endings. This spot is termed the *macula acustica*.

The macula is a cup-like depression, and from its surface a number of cilia project. These are implanted in a layer of gelatinous mucoid material, in which are also found a number of loosely connected otolith crystals. These consist of carbonate of lime, and usually have a rounded or elongated form.

The membranous semicircular canals correspond in number, position, and general outline to the bony canals, but their size is but one-third that of the latter. Their structure is practically identical with that of the utriculus. Each of the ampullæ is much larger and thicker than the other portion of its canal, and very nearly fills the bony cavity in which it is contained. Into the interior of each one projects a crest called the *crista acustica*. These closely resemble in structure the macula acustica, but the cilia are of greater length and the layer of otoliths surmounts the crest like a cap. Each of the semicircular canals is attached along its convex border to the contiguous bony wall by means of a dense connective tissue. The utricular chamber does not directly communicate with that of the saccule at their point of contact, but only indirectly through the medium of a delicate membranous tube which connects with the endolymphatic duct of the saccule.

The sacculus is rather oval than spherical in shape, being flattened a little from without inward. At its lower part, near the cochlea, there leaves it a short canal—the *canalis reuniens*—which joins the ductus cochlearis. The inner wall of the sacculus is closely united to the inner wall of the recessus hemisphericus, this union being effected by connective tissue and by the entrance at this point of the ramulus sacculi of the auditory nerve. The filaments of the nerve make their way into the vestibule through the group of perforations in its bony wall which make up the *lamina cribrosa*, and they terminate in the saccule in the macula acustica. In the cochlea the connection between

the bony and membranous structures is so intimate that they are best studied in association. Reference has already been made to the bony cochlea and to the fact that its spiral tube is partially divided, longitudinally, into two parallel scalæ by a bony plate—the lamina spiralis—which projects almost at a right angle from the modiolus or axis. Owing to the fact that this lamina does not reach all the way to the bony wall of the cochlea opposite the modiolus, a space is left which is filled by a membranous extension from the free border of the bony lamina. This is the lamina spiralis membranacea, and its attachment to the outer wall of the cochlea is effected through the medium of a cushion of fibrous tissue called the *ligamentum cochleæ*. Although apparently a simple membrane, this lamina membranacea is in fact a canal, and has been named the *ductus membranaceus cochleæ*. Not far from the outer edge of the upper margin of the bony lamina spiralis there arises a very delicate membrane—the membrane of Reissner—which by passing outward and upward to the upper edge of the ligamentum cochleæ cuts off and encloses this small, triangular passage, called the ductus cochleæ or the scala media. Of the other two passages occupying the spiral tube of the cochlea the upper is called the scala vestibuli, because of its communication at its inferior extremity with the vestibule; and the lower is known as the scala tympani, because it terminates below at the fenestra rotunda, the membrane of which is the only structure interposed between it and the tympanic cavity. The two scalæ join one another at the apex of the cochlea through the helicotrema. The membranous labyrinth of the cochlea consists of the scala media or ductus cochleæ. This tube, triangular upon section, follows the course of the lamina spiralis from its lower to its upper extremity, but is closed at both ends. Near its lower extremity, however, it is connected with the sacculæ by means of the ductus reuniens. An odd anatomical feature of this tube is that instead of diminishing in calibre from the base to the apex of the cochlea its capacity increases as it approaches its upper extremity.

The floor of the ductus cochlea is formed partially by the osseous, but principally by the membranous lamina spiralis (the *membrana basilaris*). Its sloping roof is the membrane of Reissner, and its external boundary is the ligamentum cochleæ. A very thin membrane, described by Corti and called the membrane of Corti, or the *membrana tectoria*, extends outward from the point of origin of Reissner's membrane and the upper edge of the free border of the bony lamina spiralis to the outer wall of the cochlea. The organ of Corti consists of two rows of rod-like bodies and of several rows of ciliated cells which rest on the *membrana basilaris* and are covered by the *membrana tectoria*. The two rows of rod-like cells are called the inner and outer rods of Corti, and are slightly separated from one another at their bases. This intervening space is called the *zona arcuata*. At their apices the opposing extremities of these rods meet and form a continuous arch, which covers the *zona arcuata*. A very minute canal is thus formed, which extends throughout the whole length of the cochlear tube. The nerve filaments terminate chiefly in the ciliated cells.

The arterial supply of the labyrinth consists of (1) the internal auditory, a branch of the basilar; (2) some branches from the occipital; (3) the stylomastoid, which comes from the posterior auricular. At the bottom of the internal auditory canal the artery of that name divides into the vestibular and cochlear branches. Numerous small vessels that have their origin from the cochlear branch pass through the canals in the modiolus, and are distributed over the bony and membranous spiral laminae in a capillary network. The vestibular branch breaks up in the same manner and is distributed to the membranous labyrinth. The veins which drain the vestibule, the semicircular canals, and the cochlea terminate in the superior petrosal sinus.

The auditory nerve is the eighth cranial, which was formerly described as the portio mollis of the seventh. It is not nearly so dense and resistant to pressure as is the portio dura, and therefore

it is much more liable to injury from pressure than is the latter. Its superficial origin is at the lower border of the pons, in a groove between the olivary and restiform bodies. There are two deep origins, both within the medulla. The fibres of the first root come from a ganglionic nucleus in the floor of the fourth ventricle. The second root springs from a special large-celled ganglionic nucleus in the crus cerebelli, and as it leaves the medulla it develops a small ganglion resembling those of the posterior roots of the spinal nerves. Both roots quickly unite and form a common trunk which enters the internal meatus and there again divides into the vestibular and cochlear branches. The first of these bears a small ganglion—*intumescencia gangli-formis Scurpe*—and sends branches to the ampullæ and to the utriculus and the sacculus. The cochlear branch is much the larger of the two, and after sending a slender branch to the septum membranaceum, between the utriculus and the sacculus, and to the macula cribrosa, it appears upon the first turn of the lamina spiralis, and supplies this structure from this point to its termination at the apex of the cochlea.

It has been shown that a number of the fibres of the auditory nerve spring from a group of motor cells in the bulb, and, moreover, that these fibres are to be traced into the inferior cerebellar peduncles. The belief is justified, therefore, that in addition to the sensory fibres of the auditory nerve there are others that have a motor function, and that these latter, being distributed to the ampullæ as well as to the cerebellum, may serve to explain the reflex phenomena of disturbed equilibrium accompanying irritation within the ampullæ and semicircular canals.

PHYSIOLOGY. The functional value of the auricle as a collective appendage with reference to the sound waves is probably not very great; but, nevertheless, it doubtless has some influence in directing them toward the meatus. The external canal conveys them to the tympanic membrane, which records and transmits them to the chain of ossicles with which it is in such intimate

relationship. This sensitively mobile mechanism carries the wave impressions to the fluid of the internal ear through the medium of the foot-plate of the stapes.

The membrani tympani and the chain of ossicles derive their functional importance from the fact that sound waves passing directly from a gaseous (the air) to a fluid medium (the perilymph) are greatly reduced in energy. The intervening drum-membrane and ossicular chain are, however, much more responsive to the waves, and through these the vibrations are transferred to the inner ear fluid without any appreciable loss. Their further progress toward the terminations of the auditory nerve in the organ of Corti is through the fluid of the anterior labyrinth. These nerve-endings are thrown into movement, and the resulting sensations are conveyed along the nerve trunk to its centre in the brain. It is probably the function of the cochlea to record the *pitch* of sounds, each delicate shade of variation affecting its own minute portion of the spiral distribution of the nerve.

It is scarcely likely that the secondary tympanic membrane—that of the fenestra rotunda—has any direct auditory function. It seems more probable that by virtue of its elasticity it provides a mechanical means of protecting the delicate structures contained within the bony labyrinth from any abnormal pressure to which they may be subjected by extraordinary movements of the stapes.

It seems reasonable to suppose that the saccule, being the only portion of the labyrinth to be found in invertebrates, is intended to appreciate merely the intensity of sounds.

It was formerly believed that the semicircular canals constituted the means by which we were enabled to recognize the direction from which sounds came to us. This theory has been generally abandoned, however, for we have become aware that the appreciation of the direction from which a sound proceeds is the result of an unconscious comparison of its relative intensity in the two ears ; consequently, one who has lost the hearing of

one ear is quite unable to locate with any certainty the point whence a sound comes.

The function of the posterior labyrinth, comprising the utricle and the semicircular canals, is now almost unanimously believed to be that of sense of motion with an associated sense of equilibrium. The mechanism of the sensation has been explained as follows: each of the semicircular canals becomes a complete circle by reason of its junction with the saccule; occupying a position of prominence in each circle is a membranous crest, which bristles with nerve-endings; lastly, each canal is filled with fluid. Now, when a movement of the body is made in the axis of one of these circles, the fluid within it remaining stationary, the effect produced will be that of a current in the opposite direction. This current acting upon the crista acustica will excite its nerve terminations, and so give us the sense of movement.

The fact that the axes of the three canals are placed at right angles to one another accounts for the infinite variety of sensations regarding movement that we obtain.

CHAPTER XV.

EXAMINATION OF THE EAR.

THE revolving chair for the patient that has been described in connection with rhinological and throat work is excellently well adapted to the examination and treatment of the ear. The position of the patient can be easily and quickly changed from one side to the other without his leaving the chair, nor need the light be moved. The same head-mirror, also, will prove equally satisfactory in both branches of work. A focal distance of eight inches will be neither too short for the nose and throat nor too long for the ear, and it will be adjusted and managed in precisely the same way in either case. The recommendation by some authors that the mirror be adjusted above or to the outer side of the left eye, and that this eye should look under or around its margin, seems entirely without reason. There can be no better artificial light than the Welsbach in the Mackenzie condenser, and, therefore, for the inspection of the ear the only addition that the rhinologist need make to his list of instruments will be a nest of ear specula. Several varieties of this little instrument are offered by the makers under the names of Gruber, Politzer, Wilde, Toynbee, and Kramer. That designed by Gruber possesses all the advantages of the others, and is alone in having its cross-section oval in shape, as is that of a similar section of the auditory canal. This speculum is best made of silver, though it can also be had in hard rubber, and the examination will be the more satisfactory with the silver instrument if the inside of its contracted portion is highly polished, while the dilated portion is blackened on the inside. The use of a speculum is rendered necessary by the occasional presence of an abundant growth of

hair about the orifice of the auditory canal, and also by the angular curvature in the course of this canal. (Fig. 97.)

In order that we may estimate the mobility of the drum-membrane and discover whether or not it is bound down by adhesions, a special instrument has been devised—Siegle's pneumatic otoscope. This consists of a hard-rubber speculum, the outer or dilated extremity of which is closed by an obliquely placed thin disk of glass. When this is inserted into the auditory canal it becomes, owing to the closure of its outer extremity, an air-tight chamber. In the longer side of its wall is an opening which communicates, by ten or twelve inches of rubber tubing, with a small Politzer bag, or, what is very much better, a Delstanche masseur. The speculum or ear-piece attached to this instrument

FIG. 97.



can be unscrewed and different sizes employed. If the open extremity of the speculum be covered by a piece of thin rubber tubing it will not only make it fit the canal more accurately, but it will lessen the pain or discomfort that its introduction may occasion. When it is snugly within the canal we are enabled to clearly observe the movements communicated to the drum-membrane by the rarefaction or condensation of the air in the canal by the masseur. This is the only reliable means by which we may determine with any accuracy the degree of mobility of the drumhead. It is true that both the Politzer and Valsalvan methods of inflation, if performed while the physician is watching the membrane, will inform him whether or not it is movable; but the extent of its movement can be little better than guessed at by these methods. It need scarcely be added that should the

Eustachian tube be impervious, the Siegle otoscope becomes our sole means of putting the membrane in motion. (Fig. 98.)

In the examination of the ear it is highly important that the employment of the speculum should be preceded by an inspection of the external portion of the ear—the auricle, the orifice of the auditory canal, and as much of the canal itself as can be seen without instrumental aid. We can discover in this way any

FIG. 98.



Siegle's otoscope, with masseur of Delstanche attached. (BACON)

inflammatory redness or swelling of the tissues, the presence of furuncles, eczema, or neoplasms, or, finally, evidences of traumatism or the existence of malformations.

This having been disposed of we are ready to introduce the speculum and study the deeper portion of the canal. In order to accomplish this most easily the auricle is grasped at its upper and posterior margin and drawn sufficiently upward and backward to obliterate the curve of the auditory canal. While it is

held in this way the speculum, in the grasp of the thumb and index finger, is carried to the meatus and then gently propelled as far into the canal as possible without inflicting pain. Its general direction will be downward, inward, and forward, or more or less toward the patient's nose. The speculum should be warmed before its introduction, and when it has entered the canal to a sufficient depth it should be held there with some firmness to overcome its tendency to slip out. The beginner's difficulties usually arise from timidity. He either fails to insert the speculum far enough to obtain a view of the tympanum, or, in the effort to do so, he hurts the patient and is compelled to desist, because of his attempts to push or pry the instrument into position without having first sufficiently straightened the canal by upward and backward traction on the auricle. When the light reflected from the head-mirror is thrown into the speculum the student may have some difficulty in locating the drum-membrane, and he should beware of mistaking for it the walls of the canal which may, at times, resemble somewhat an inflamed membrane by their pinkish coloration and their smooth and shining surface. This mistake will be avoided by being careful to keep the speculum directed accurately in the long axis of the canal. A partial or complete view of the membrane will then be had, and it will be scarcely possible to confuse it with the adjacent walls of the canal.

It may save the student much discouragement if he be assured beforehand that he will probably have to examine many membranes before his eyes will acquire the power to detect the little inequalities in their surface, the delicate variations of color and thickness, and to interpret the meaning of each.

At the entrance of the cartilaginous meatus the speculum may encounter a more or less luxuriant growth of fine hairs, and beyond these it is not unusual to find a film of cerumen lining the walls. If this secretion enters the speculum, as it is very apt to do, its lumen will be narrowed and the view of the parts

beyond proportionately diminished. When possible the speculum should be introduced so far that only the drum-membrane and the adjacent walls of the osseous meatus enter the field of view. The skin lining this portion of the meatus is usually of a pale or delicate pink color.

Although the color of the normal *membrana tympani* is commonly described as "pearly-gray," yet the fact that it is a semi-transparent membrane will account for numerous modifications of this tint. Alteration of the contents of the tympanum or of the color of its lining mucous membrane will materially influence that of the drum-membrane. Its lustre is due to some special quality of the epithelium covering its outer surface, and it will be diminished or lost should the epithelial layer be moistened or desquamated. At the centre of the membrane—the *umbo*—we find the lower extremity of the handle of the malleus, and from this point it runs upward and slightly forward to within a short distance of the margin of the membrane. It terminates in a slightly pointed prominence—the *short process*—and from this point two more or less distinct ridges or folds of the membrane pass—the one forward, the other backward—to its periphery. Between and above these folds is the so-called *Shrapnell's membrane* or *membrana flaccida*. The median or fibrous layer of the tympanic membrane is missing from this portion, and, therefore, it is peculiarly susceptible to perforation.

The boundaries of this upper part of the membrane are not at all distinct, and the point at which it meets the wall of the meatus, owing to the obtuse angle of their union, can seldom be accurately defined. Any unusual retraction of the membrane will bring the short process of the malleus as well as the folds radiating from it into greater prominence.

For purposes of clinical record and description, that portion of the tympanic membrane below the *membrana flaccida* has been divided into quadrants. These are shown in Fig. 99.

The *cone* or *pyramid of light* is seen in the antero-inferior quadrant of the membrane. Its apex is at the tip of the handle of the malleus, and, passing from this point downward and slightly forward, its base rests upon the periphery of the membrane. This bright triangle is the result of the crossing of the rays of light reflected from the curved surface of the membrane, and, therefore, any alteration in the degree of curvature of the membrane will be indicated by a proportionate alteration of the dimensions and brilliance of this pyramid. In the event of any marked retraction of the membrane the base of the triangle will recede from the periphery toward the centre, and in extreme degrees of retraction it will be almost entirely abolished. It will be readily inferred from this that any departure from the normal

FIG. 99.



appearance of this bright spot will have its diagnostic significance. In this connection it may be noted that in quite a number of instances the curvature of the auditory canal is so great that the antero-inferior margin of the membrana cannot be seen.

The condition of the auditory canal and drumhead having been ascertained, the next step in the examination should be a thorough investigation of the nasal and postnasal cavities and the faucial region. When we recall the enormous percentage of ear affections that have their origin in disease of the nose and throat, there will be no need to emphasize the importance of this part of our examination. The methods by which these cavities are

examined have already been sufficiently described, and there is only occasion now to refer to those affections of the nose and throat that are most frequently provocative of disturbance of the Eustachian tube and middle ear.

Whatever its cause may be, whether local or systemic, the occurrence of an acute or chronic inflammation of the nasal and nasopharyngeal mucous membrane is liable to lead to a similar process in the tubal and tympanic mucous membrane. The most powerful predisposing cause of acute attacks is the presence of a chronic catarrhal inflammation, and this should be recognized and due consideration given it. Much weight will attach to any obstructive element within the nasal fossa. Appreciating the fact that the physiological termination of the Eustachian tube is at the anterior nares rather than in the nasopharynx, we realize that any obstruction of the respiratory portion of the nose is equivalent to an obstruction of the tube itself. Mucous polyps, hypertrophied inferior turbinates, and various septal deformities will, therefore, directly affect the middle ear by interfering with its ventilation, and so by occasioning a partial vacuum within it will favor a persistent hyperæmia of its mucous lining.

There is no more frequent cause of ear troubles in children than the presence of adenoid vegetations in the nasopharynx. These are not only responsible for much pernicious catarrhal activity in this space which almost inevitably extends to the tubes, but also, when of considerable size, they directly obstruct the tubal openings and cripple their ventilating and drainage functions.

Likewise the faucial tonsils when they are the seat of marked hypertrophy, will hamper the freedom of movement of the soft palate and interfere with the dilating action upon the Eustachian tubes of its levator and tensor muscles.

Examination of the Eustachian Tube and Tympanum.

It is essential for us to acquaint ourselves in every case with the degree of permeability of the Eustachian tube. We have at

our disposal three methods by which this knowledge may be gained. Each of them contemplates the inflation of the middle ear with air, and they will be described in the order in which they are usually resorted to. In conjunction with them an auscultation or diagnostic tube is used, one end of which is inserted into the ear of the patient and the other into that of the aurist. This tube consists of a yard of black rubber tubing with two end-pieces, that for the examiner's ear being white, while the other is black. By means of this tube the sounds produced in the Eustachian tube and the middle ear by the forcible entrance of air into them are conveyed to the ear of the examiner, and are interpreted by him as indicating one of a number of possible pathological conditions. For instance, while the inflation of the normal tympanum will be accompanied by nothing more than a dull click, a whistling or hissing sound will announce the existence of a perforation in the drumhead, and a moist, bubbling sound will apprise us of the presence of fluid in the tympanum. Other sounds slightly varying from these may be heard at times, but it is only an uncommonly keen and skilled ear that can draw reliable diagnostic distinctions from such slight variations.

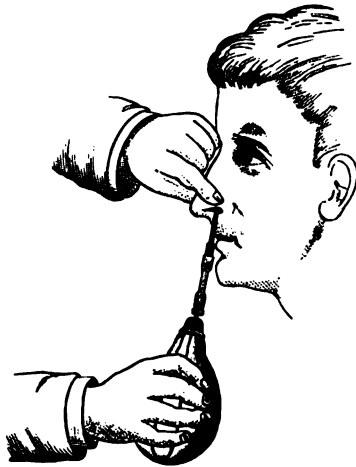
The ventilation of the normal ear is secured by the dilatation of the Eustachian tube with each act of swallowing, and an equal air pressure is thus maintained upon either side of the tympanic membrane. Artificial inflation may be accomplished in the following three ways :

Valsalva's Method. This may be successfully employed in the lesser degrees of Eustachian obstruction—those which may be overcome by the application of a moderate amount of force. The patient closes his nostrils with his thumb and index finger, closes also his mouth, and then blows out his cheeks, and at the same time swallows. If the distention of the cheeks and the act of swallowing are simultaneous, forcible blowing is usually entirely unnecessary, and the objection against this

procedure—that it produces congestion of the head—will not be justified. Very little, if any, practice is ordinarily needed for the satisfactory carrying out of this simple method. While the patient inflates his middle ear in this way the surgeon illuminates the drum-membrane through the speculum and assures himself at the same moment of its mobility and of the patency of the tube.

The daily employment of this means of inflating the ears should not be carelessly recommended to patients, for they are too often disposed to use too much force, and this will lead in time to overstretching of the ossicular ligaments and to a consequently relaxed condition of the tympanic membrane.

FIG. 100.



Poltzer's method.

Poltzer's Method. The amount of force employed in this method can be proportioned pretty closely to the degree of obstruction encountered in the tubes. The mechanism involved in its successful application includes the elevation of the soft palate, thus shutting off the postnasal space from the lower pharynx, the simultaneous dilatation of the Eustachian orifices in the nasopharynx, and the discharge at this moment through the nasal fossa of a column of air which, entering the gaping tube,

passes through it to the middle ear. The apparatus used consists of a rubber bulb of six or eight ounce capacity, to the nozzle of which is attached a rubber tube from two to six inches in length, fitted at its distal extremity with a hard rubber, wooden, or glass nose-piece. The size and shape of the latter vary according to the fancy of the surgeon. The bag is sometimes made with an opening in its side, in order that it may be refilled with air without removing the tube from the nose. (Fig. 100.)

In applying this method the patient is given a sip of water to facilitate the act of swallowing, and is told to retain it in the mouth for a moment. The operator quickly introduces the tube into the nose, closes both nostrils by compressing them between the thumb and index finger of his disengaged hand, and then, telling the patient to swallow, he expels the air from the bag the instant the larynx is seen to rise. If the bag has no valve in its side it is desirable to remove the tube from the nose before permitting it to refill, in order that there may be no suction of nasal secretion into the tube.

This is the original method of Politzer, but it may be somewhat modified at times. Politzer himself, on occasions, instead of invoking the act of deglutition, permits the patient to inspire through the nearly closed lips while he propels the air from the bag into the nasopharynx. The soft palate is retracted and the Eustachian orifices opened equally well by this device. Another modification, proposed by Gruber, is that the patient, instead of swallowing water, shall pronounce with somewhat exaggerated distinctness the word "hick" or "hock" at the moment the operator forces the air into the nose. It is quite often advisable in our younger or more nervous patients, to prepare them by a few words of explanation for what is about to happen, in order that they may not be severely startled by the suddenness or the explosive noise with which the air is apt to enter the ear.

In inflating a tympanum in which fluid is known or suspected to be present, its escape will be favored if the patient's head is

thrown a little forward and inclined to the opposite side. In cases of purulent otitis with perforation of the tympanic membrane Politzerization has been condemned by some otologists on the ground that the secretion may be driven into the mastoid cells. Unless the perforation is extremely minute, however, such a result is highly improbable.

Where the Eustachian obstruction is due to acute catarrhal swelling of recent origin, the hyperæmia and hypersecretion within the middle ear that quickly follow upon the lowering of the air-pressure are usually promptly relieved and perhaps arrested, by restoring the balance between the inner and outer air by the Politzer method of inflation.

It may not be needless to direct the attention of the student to the fact that one feature of this method becomes at times a disadvantage, viz., that it is not one but both ears that are affected by the inflation. Where repetition of the inflation of one ear is required for any considerable period of time, the other being normal, the use of the catheter is to be preferred to that of the Politzer bag. The disturbing effect of the inflation upon the normal ear can be greatly diminished, however, by directing the patient to firmly press the tragus into the meatus of that side. By doing this the tympanic membrane is supported by the resisting column of air that is thus inclosed in the canal. The protection afforded in this way may be still further increased by tilting the head to the side opposite to that of the affected ear.

Catheterization. In this procedure a catheter is carried back through the nasal fossa into the postnasal space, its tip inserted into the Eustachian orifice, and the air from the Politzer bag driven through it into the tympanum. (Fig. 101.)

The catheter may be of silver or hard rubber, is from four and a half to six inches in length, and is curved at its distal extremity. To the handle is attached a small ring or button which is on the same side and in the same plane as the circle of which the curve at the tip is an arc. This little appendage gives the

surgeon precise information as to the position of the beak of the catheter when it is in the nasopharyngeal cavity. These catheters are to be had in sets of three or four sizes, adapted to different ages, and the possibility of inflicting pain or injury by their introduction is much diminished if the beak is given a probe point. As usually made, the beak has an abrupt, almost sharp margin, and in any but the gentlest and most skilful hand is apt to wound the mucous membrane and give rise to the possibility of a cellular tissue emphysema.

Method of Introduction. Nothing more clearly denotes the skilled otologist than the manner in which he handles the Eustachian catheter. Even in the lightest hand the passage of this instrument through the nasal fossa is apt to be exceedingly disagreeable to the average patient. If the fossa be of less than normal capacity and its mucous membrane hypersensitive, there

FIG. 101.



Eustachian catheter.

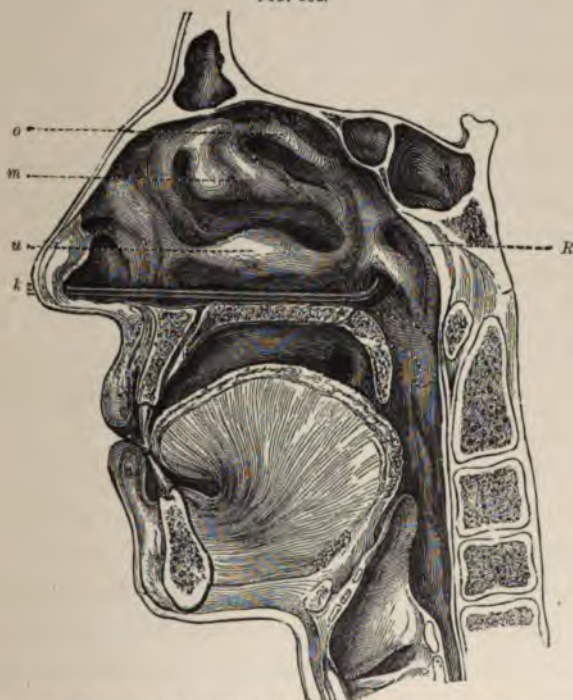
will even be more or less accompanying pain, and it need scarcely be urged, therefore, that no measure should be neglected that can lessen the patient's discomfort or suffering. I think the preliminary application of a 2 per cent. solution of cocaine should be a matter of routine. The cotton-carrier offers the best means for its application, and it may be limited to the floor of the nose, the inferior turbinate, and the Eustachian orifice. The latter point may be reached by giving the tip of the applicator a curve corresponding to that of the catheter. This cocainization of the lower meatus is of course preceded by a thorough spraying of the nose and the removal of any secretion that it may contain. The passage of the catheter will be further facilitated if it be lubricated with an ointment of some kind, preferably one of an anti-septic nature. The fingers of the surgeon's left hand are now placed

upon the patient's forehead and the tip of his nose raised by the thumb placed beneath it. The catheter is held almost vertically in the right hand, and its beak is carried through the vestibule and placed upon the floor of the nose. As it is passed backward *in constant contact with the floor* the handle is quickly raised until the instrument is horizontal. Almost no appreciable force should be used in its propulsion. When the tip reaches the downward curving surface of the soft palate and slips from it into the post-nasal space the surgeon has the choice of two or three methods of finding the Eustachian orifice. By the first of these the curved extremity is sent all the way back to the pharyngeal wall. It is then turned outward until almost horizontal and drawn a little forward. It will now occupy the fossa of Rosenmüller, and a little further retraction will bring it in contact with the projecting posterior lip of the tubal opening. Permitting it to droop a trifle will enable it to clear this prominence, and then if it be immediately turned outward and upward again until the metal ring attached to the handle of the catheter points toward the outer canthus of the eye of the same side the beak will enter the cup-shaped orifice of the tube. According to Politzer, this direction of the beak will correspond, as a rule, with the axis of the tube. A second method is based upon the anatomical fact that the posterior border of the vomer at the level of the nasal floor just meets a line drawn from one Eustachian opening to the other. If, therefore, the curved end of the catheter, after reaching the nasopharynx, be turned inward until horizontal, and be then withdrawn, it will be arrested by the septal border immediately opposite the tubal orifice. It is but necessary now that the beak shall be swept downward and outward until it points in the direction mentioned in the first method, in order that it may enter the tube. A third and last device directs that the catheter, having entered the nasopharynx, shall be withdrawn with some little downward pressure until its curve impinges upon the resisting border of the hard palate. If the beak be now

turned outward and upward it will be just in front of the opening of the tube, into which it may be inserted by a slight backward movement. (Fig. 102.)

The obstacles that may make the passing of the catheter a matter of some difficulty consist of various deformities of or

FIG. 102.



Inner view of the right half of the head, antero-posterior section. (GRUBER.)

o. Superior turbinated bone. *m.* Middle turbinated bone. *u.* Inferior turbinated bone. *R.* Rosenmüller's fossa, bounded in front by the cartilaginous lip of the tube; in front of the latter is the pharyngeal opening of the Eustachian tube, in which the catheter *k* is placed.

cartilaginous or bony projections from the septum, hypertrophy of the lower turbinates, the presence of synechiæ in the lower meatus, or of mucous polypi. The preliminary removal of any of these nasal obstructions is, however, essential to the successful treatment of any aural disturbance, and with a fairly clear nasal fossa Eustachian catheterization requires no more than a little

practice to be quickly and easily performed. Here, again, however, it will be both considerate and advisable for the surgeon to precede the first performance of the operation upon any patient by telling him what he is about to attempt to do. If the latter's fears are allayed in this way success will be greatly favored by the absence on his part of any resistance or nervous movements. When the beak of the catheter has been lodged in the tubal orifice its shaft is transferred from the right hand to the thumb and index finger of the left, and it is steadied and retained in position by the placing of the other fingers of the left hand upon the patient's nose. Clamps and other mechanical aids for this purpose are rarely, if ever, needed. We are now ready to inflate the middle ear, and the Politzer bag affords us the means for doing this. It is usually advised that the hard-rubber nozzle of the bag shall accurately fit the socket in the handle of the catheter. If made in this way, however, it is not at all infrequent for them to become pretty firmly locked, and the force required for their separation is apt to displace the tip of the catheter and possibly inflict some pain upon the patient. It is much better, I think, for the nozzle of the bag to have a rounded or bulbous tip. The amount of air that this will permit to escape at its junction with the catheter is quite insignificant, and will be more than compensated for by the avoidance of the accident just described.

Inflation by means of the catheter has several advantages over Politzerization. In the first place, it is more direct, and the greater amount of force that we are enabled to exert through it will frequently make it succeed where the Politzer method would fail. Again, if but one ear requires treatment the drum-membrane of the other will be protected from the effects of the frequent inflation that may be necessary. Finally, the degree of force used can be more accurately proportioned to the resistance through the medium of the catheter than by the method of Politzer. The force used, by the way, should always be slight at first and only gradually increased. By observing this pre-

caution we will avoid a possible rupture of an atrophied membrane.

It is often advised that in the event of impassable obstruction of one nasal fossa the corresponding Eustachian tube shall be catheterized through the other fossa, a catheter with a somewhat sharper curve being employed. If, however, there is anything in the belief that nasal obstruction is largely responsible for pathological conditions of the ear (and who, at this day, doubts it ?) the very first step in the treatment of such conditions should be the restoration of the nose to a normal state of patency. Before this is done, catheterization, except for purposes of diagnosis, can be of but very little value.

It need scarcely be added that the diagnostic tube should be used in conjunction with the catheter, as it is with the method of Politzer, in order that we may be certain whether or not air has entered the middle ear. The mere statement of the patient is seldom entirely trustworthy.

Measurement of the Hearing Power.

The perception of sounds by the auditory nerve is the result of the conduction of the sound waves by way of the external auditory canal to the tympanic membrane, and of the communication of the ensuing vibrations of the chain of ossicles, through the footplate of the stapes, to the labyrinthine fluids. The following of this route is known as *aërial conduction of sound*. The perceptive apparatus may also be aroused by means of the vibrations that sound is capable of exciting in the bones of the cranium or face. Hearing through this medium is known as *bone conduction of sound*.

No diagnosis of disease of either the conducting or perceptive portions of the ear can be complete, without an intelligent application of the various acoustic tests and a clear comprehension of the results that they give. Their very great importance arises from the fact that they not only inform us of the particular por-

tion of the ear affected, but that they enable us to closely follow the course of the disease and help us to a timely decision as to the value or futility of the treatment employed.

Of the simpler yet somewhat cruder tests of the hearing power the watch is probably the most often resorted to. It cannot have a wide applicability, however, because the watch affords but two notes, and these are not only of poor quality, but they vary greatly as regards both intensity and pitch.

For this test it is well to have two watches, the one having a tick of higher pitch and intensity than the other. The average distance at which they are heard by several normal ears is first carefully measured, and this distance becomes the denominator of a fraction which subsequently serves to record the hearing of defective ears. In applying the test the meatus of the ear opposite to the one to be examined is stopped with the moistened finger, and then the watch, starting from the point at which it is normally heard, is gradually carried toward the ear until its tick is unmistakably perceived by the patient. This distance is measured, and then becomes the numerator of the fraction by which the hearing is recorded. For instance, if the ear hears a fifty-four-inch watch at eight inches the result is expressed by the fraction $\frac{8}{54}$. The patient's eyes should be closed during the test.

In order to overcome the inaccuracies of the watch-test Politzer devised the acoumeter. The principal features of this instrument are a steel cylinder, 28 mm. long and $4\frac{1}{2}$ mm. in diameter, above which is suspended a percussion hammer, which always falls from the same height and produces the same note — *c''*. The advantage claimed for this instrument by the inventor is that the note being of invariable pitch and intensity it affords us a standard unit of measurement for the hearing. A disadvantage of some consequence, however, is that the distance at which its note is heard by the normal ear is forty-five feet, so that, except in cases of marked deafness, the watch, although inaccurate, is much more convenient.

The various phonic voice tests, in spite of all possible precautions, are not to be depended upon. The whisper, however faint or loud, produced by the "reserve air"—that which remains after ordinary tidal expiration—is much less variable than the voice, and, therefore, much more precise in the information it gives. The test-words employed should be well adapted to the purpose, and are to be repeated by the patient. It may not be superfluous to caution the student that either the patient's eyes should be closed or his face turned from the speaker, in order that he may not observe the movements of the latter's lips.

The average normal ear is capable of perceiving sounds corresponding to vibrations ranging in number from 15 to 40,960 per second. These limits, however, may vary somewhat in different individuals, even in the absence of disease. For testing the hearing within these limits the aural surgeon should be provided with a series of tuning-forks and a Galton whistle. For all ordinary purposes three forks will probably prove quite sufficient. Those of most general utility would be A-213, C²-512, C⁴-2048. The fact that in cases of incipient catarrhal deafness the hearing for the low-tuned forks is first lost will make an A-53 fork a frequently useful addition to the above set. This note should be distinct to any normal ear, and its early loss would have, therefore, decided diagnostic significance. In examples of labyrinthine disease, on the contrary, it is the higher-toned forks that first become inaudible. It is essential that some means be taken to suppress the overtones in these instruments, and for this purpose clamps are usually attached to their extremities. (Fig. 103.)

As has just been intimated, the chief value of the tuning-fork as an instrument of diagnosis is in the differentiation of disease of the middle from that of the internal ear. Sound reaching it by aerial conduction is perceived more distinctly and loudly by the normal ear than when the same sound is communicated to it through the bone. Again, if the external meatus of one side be closed, the sound of the tuning-fork placed against the mastoid

process or upon the top of the head will be intensified in and heard for a longer time by the closed ear. This statement applies with equal force to an ear the external or middle portions of which are affected by disease. The value of this clinical fact lies in its diagnostic application to any case of deafness, for if the fork be heard in the affected ear better by air than by bone conduction we are justified in concluding that it is in the perceptive and not the conducting apparatus of the organ that the disease is located.

FIG. 103.



Fork with clamps to control overtones.

FIG. 104.



Galton whistle.

In deafness due to labyrinthine disease it is the forks of higher pitch that first become inaudible, and it is these, therefore, that are best adapted to the testing of this portion of the ear. Even better than these forks, however, is the Galton whistle or the König rods. These latter instruments have a far higher range of tone. The first is a cylindrical whistle, the note of which can be altered by means of a screw arrangement, the change of pitch being denoted by the numbers of a scale that is imprinted upon the instrument. Its compass extends over more than the

three highest octaves—in vibrations from about 4000 to 80,000 per second. (Fig. 104.) The König rods consist of a series of steel rods or cylinders, the graduated lengths of which give them a tone-range of from 20,000 to 80,000 vibrations in the second.

Rinné's test consists in determining, by means of the tuning-fork, the comparative conducting power of the air and of bone, and, inferentially, the comparative integrity of the conducting and of the percipient portions of the ear. The vibrating fork is first placed upon any point in the middle line of the head and kept there until its tone becomes inaudible. If, without being re-struck, it should then be carried close to the meatus and its sound again becomes distinct, we may conclude that the conducting apparatus is normal. If the reverse be true—that is, if the vibrating fork be held before the ear until its sound dies away and its transference to the vertex again makes it audible—the conclusion is inevitable that there is some more or less serious derangement of the sound-conducting apparatus. The first of these results is termed the *positive* Rinné test, while its reverse is known as the *negative*.

In applying this and the following test it is important to remember that the ability of bone to transmit sound to the ear is very much diminished in old age. This senile loss of conducting power is so great that, according to Politzer, the instances are rare in which, after the sixtieth year, a low-ticking watch can be heard through the cranial bones.

The negative Rinné test will evidently be of most value in the recognition of those cases of marked deafness due to affections of the external and middle portions of the ear. Its diagnostic significance is clearly apparent in such cases unless there happens to be some coincident involvement of the labyrinth.

In the milder degrees of middle-ear deafness *Weber's test* is apt to give us more accurate information. This test prescribes that a vibrating fork, usually one of 512 v. s., shall be placed upon some point or series of points in the middle cranial line,

and that it be observed whether conduction through the bone is better on one side than on the other. If care be taken by repeating the test some several times in cases of doubt, it will usually be successful in lateralizing the sound to the worse ear in obstructive and to the better ear in perceptive disease. Uncertainty with one fork may often be dispelled by trying one or more others of higher or lower pitch.

By the foregoing methods we are generally able to at least localize the seat of disease ; but we can do more than this, and measure with a sufficient amount of accuracy the degree of defect in the function of the internal ear. This we are enabled to do by employing a test suggested by Gardiner Brown. He found that by applying a gently vibrating fork to the bridge of the nose of a person with normal hearing its vibrations could be felt by his fingers for precisely the same length of time as its sound could be heard by the subject. He, therefore, proposed that we designate the bone-conducting power of a patient by recording in seconds—plus or minus—the interval that elapses between the surgeon ceasing to feel the vibrations and the patient ceasing to hear the sound that they occasion.

After some practice with this measure we should be able to detect a discrepancy of but a second's duration, and even this will justify our suspecting some implication of the perceptive apparatus. To obtain reliable information from this method the surgeon's fingers will usually need some little education before they will be able to perceive the exact moment at which the fork ceases to vibrate. It will be wise, also, to repeat the experiment two or three times in order that we may detect any mistake in the statements of the patient, and he should be specially cautioned to discriminate between what he merely *feels* and that which he actually *hears*.

Brief reference may finally be made to a method suggested by Politzer for testing the physiological permeability of the Eustachian tubes during the act of swallowing. It consists in

holding a vibrating fork before the nostrils and noting whether it is, as it should be, much more loudly heard at the moment of swallowing. The two ears may be contrasted in this way and the relative patency of the two tubes pretty accurately ascertained.

CHAPTER XVI.

DISEASES OF THE AURICLE AND EXTERNAL AUDITORY CANAL.

SINCE no other claim than that of every-day usefulness is to be urged for this book, I shall omit consideration of a number of diseases of the auricle and external canal that are not only comparatively unimportant and of infrequent occurrence, but whose treatment very commonly falls into the competent hands of the dermatologist or the general surgeon. Among these are such affections of the auricle as malformations and injuries, hæmatoma and perichondritis, cysts, dermatitis, frost-bite, tumors, and luetic lesions. The successful management of these comes entirely within the limits of general medicine and surgery, and the special knowledge and manual skill of the otologist are not at all essential to their diagnosis or cure. One disease, however, that is of much more frequent occurrence than any of those named, and which often proves much more resistant to treatment in this than in other regions is eczema.

Eczema.

The simplest classification, and one that is quite sufficient for practical purposes, is into the acute and chronic forms. The former of these is usually moist, the latter dry. The acute variety may attack both ears or but one, and it may originate either upon the auricle or within the meatus, or it may involve them secondarily by extension from the skin of the scalp or face. No age or sex is exempt, but the greater number of cases is found among children and females. As a rule, both the auricle and meatus are simultaneously involved. The symptoms marking

the acute attack are redness and swelling of the affected region ; vesicles or pustules are of common occurrence, and the itching and burning are often so intense that the irresistible desire to scratch or rub the parts is not seldom responsible for the addition of other self-inflicted lesions. The escape and inspissation of the secretion lead to the formation of crusts which may not only greatly disfigure the auricle, but, by collecting within and occluding the lumen of the meatus, may noticeably impair the hearing. The swelling of the cutaneous lining of the meatus may even be sufficient of itself to occasion some moderate degree of deafness, and to this may be added a sensation of fulness in the ears and perhaps some tinnitus. In many children, as the result of injudicious domestic treatment—bandaging, poulticing, etc.—an eczema intertrigo back of the auricle is not an uncommon complication. The disease may also arise as the result of the irritation due to a purulent discharge from an ear that is not cleansed properly or with sufficient frequency. Again, it is occasionally excited by the excoriative action of some domestic remedy that is applied to or dropped within the ear, and finally we now and again find it in children as an accompaniment of *pediculi capitis*.

Treatment. The treatment will naturally differ somewhat in the acute or moist and the chronic or dry forms of the disease. In both, however, the general health of the patient should receive our very careful attention. Gastro-intestinal disturbances and the generally associated constipation should be overcome as quickly as possible by means of dietetic and other hygienic measures. The circulation in general should be invigorated, and that of the skin in particular. If the existence of any diathetic factor be detected—such, for instance, as gout or rheumatism—its appropriate systemic treatment should be enforced. In strumous children afflicted with this disease the syrup of hydriodic acid, the elixir of quinine, iron, and strychnine, cod-liver oil, and the hypophosphites are all remedies of decided therapeutic value, but their beneficial effects will always be

greatly enhanced by their combination with an abundance of fresh air, sunshine, and exercise.

In ordinary cases the local treatment that will almost always prove successful consists of the gentle but complete removal of the crusts and scales from the affected areas by means of curettes, and the then thorough application of an ointment composed of the officinal ung. zinc. oxid., ʒj, acid. boric., ʒj. This should also be used by the patient several times during the day. In the presence of a tendency to weeping on the part of the eczema it will be more satisfactory to keep the auricle and canal thickly dusted with a powder made up of equal parts of zinc oxide and boric acid. The less water that is allowed to touch the parts the better. In obstinate cases showing a disposition to chronicity the occasional application to the diseased surface of 20 to 40-grain solutions of nitrate of silver will be of advantage.

If appropriate general measures are adopted, and the local treatment is sufficiently frequent in its application and painstaking in its thoroughness, the disease will seldom prove refractory. The necessity for suppressing any suppurative median otitis is obvious, and it will be important, also, to carefully examine the teeth, in order that any causative dental irritation, if present, may be discovered and removed.

Acute Diffuse External Otitis.

This is a general dermatitis involving the lining of the external auditory canal, and usually implicating also the cutaneous covering of the concha. It is characterized by the usual symptoms of the disease when occurring elsewhere—redness, heat, pain, and swelling—but these are apt to occasion greater disturbance in this situation because of the limited dimensions of the canal and of its proximity to the middle ear.

It is by no means of infrequent occurrence, and this is largely explained by the fact that one of its commonest causes is found in the use by large numbers of people of irritating instruments

and washes for the cleansing of the ears. Lesions of the delicate skin in this region are readily produced by the unskilled use of these articles, and become easy avenues for coccal infection. The disease may also ensue upon furunculosis of the canal, or it may be occasioned by the excoriating action of a purulent discharge from the middle ear. Prolonged exposure to cold air or to contact with cold water may also prove causative when the general systemic vitality is not what it should be.

The hyperæmia, infiltration, and consequent swelling of the meatal lining are usually so great and of such early occurrence that it is, as a rule, difficult to obtain a view of the drumhead, but the dermal layer of this almost always participates in the inflammation and leads to a considerable alteration in the appearance of the membrane. As a consequence of the often profuse serous infiltration and discharge the epithelial layer may be deeply and extensively exfoliated throughout the canal, and the subjacent layer left exposed and intensely inflamed.

The principal symptom of a subjective nature accompanying this disease is pain. There is marked tenderness upon pressure in the neighborhood of the tragus, and because of the aggravation of the pain that attends any movement of the jaw the patient is disinclined to partake of any food that requires chewing. In a certain number of cases tinnitus is a symptom of some prominence, and impairment of the hearing will be a natural concomitant of the swelling and obstruction of the canal. The degree of involvement of the tympanic membrane will also greatly influence the degree of deafness observed in any case.

Under judicious treatment the disease will usually subside within a week or ten days; but if it be neglected, or treatment be discontinued too soon, it may become chronic. In this event the occurrence of superficial or deep ulceration is not uncommon, the bone may be exposed, and this be followed by the development of exuberant granulations and polypi. The drumhead may likewise present erosions and ulcers, and if these latter extend

deeply, perforation of the membrane may result. In chronic cases we are apt to have a seropurulent discharge, offensive at times, and containing large numbers of immature epithelial cells and perhaps many micrococci. Rarely periosteitis may develop in the course of the disease, and this, through denudation of the bone, eventuate in caries and necrosis.

In unusually severe acute attacks of this disease there may occur now and then within the external meatus one or perhaps several hemorrhagic vesicles. These are usually limited to the bony portion of the canal, but at times one or more of small size may be found upon the drumhead itself.

Variations of the simple form of external otitis are occasionally encountered in the croupous and diphtheritic forms. These are very far from being of frequent occurrence, but they should not fail of recognition. The former is usually the effect of an irritating application or discharge in one whose general condition is such as to favor the production of an exudative inflammation. It is doubtful if the diphtheritic form is ever primary. The few cases that have been observed have probably all resulted from the infection of a previously inflamed canal. It may occur in conjunction with diphtheria of the fauces and pharynx, or without the coexistence of the disease elsewhere. Examination of the canal reveals the characteristic membrane lining its walls, and if it be forcibly removed small hemorrhages will occur, and a highly inflamed and more or less deeply eroded cutis be exposed. Pain is an invariable accompaniment, and tenderness and enlargement of the neighboring lymphatic glands are almost always present.

The disease if limited to the canal is not apt to prove serious, and systemic disturbance will scarcely be noticeable; but if the middle ear be invaded extensive ulcerative destruction, involving the ossicles, tympanum, bony meatus, and even the mastoid process may follow. Implication of the labyrinth will almost inevitably be attended by complete loss of hearing.

Treatment. In the early stage of the simple acute inflammation of the canal the application of the artificial leech will be of value, and the simultaneous use of Leiter's coil an active aid. The canal should be thoroughly cleansed with a warm saturated solution of boric acid, and, in case of much swelling of the tissues with severe pain, free and deep incisions extending to or through the periosteum should be made. In the less severe cases the inflammation may often be quickly restrained by gently mopping the canal with a 50 per cent. solution or ointment of ichthyol, and by introducing the same medicament within the canal upon wicks of absorbent cotton. These should be changed once or perhaps twice in the twenty-four hours. Upon the subsidence of the acute symptoms, if there be apparent a tendency to abundant secretion, the canal is to be cleansed and well dried, and a powder consisting of equal parts of boric acid and zinc oxide insufflated.

During the onset and height of the attack the administration of laxatives and the appropriate regulation of the diet should be routine measures.

In the event of chronicity accompanied by ulceration and the development of exuberant granulations or polypi, these latter are to be removed with the curette and their bases carefully touched with a saturated solution or the fused crystal of chromic acid. Should any exposed and carious bone be in evidence it is best removed with the sharp spoon. The annoying tendency of polypi to recur may very often be greatly diminished by the introduction of a saturated alcoholic solution of boric acid upon pledgets of absorbent cotton.

The treatment of the croupous and diphtheritic forms of external otitis differs but slightly from that of the simple inflammation. The membranous exudate is to be removed gently, but as thoroughly as possible, with forceps and cotton-mop, and any remaining fragments liquefied by means of hydrogen dioxide. A 1 to 3000 solution of the mercuric chloride may then be applied

throughout the canal, and this followed by the insufflation of equal parts of boric acid and iodoform.

Acute Circumscribed External Otitis—Furunculosis.

The frequency of this disease, the very great pain usually attending it, and its tendency to recur at brief intervals give it an importance quite out of proportion to its seriousness. It consists of a circumscribed inflammation of the skin and subcutaneous tissues of the external auditory canal, the process commonly terminating in the development of a small abscess or furuncle which undergoes either resolution or spontaneous rupture. These boils may be either single or multiple, and they may occur in any portion of the canal. Most often, however, they are found in the cartilaginous meatus, due, no doubt, to the greater abundance in this region of sebaceous glands and hair follicles.

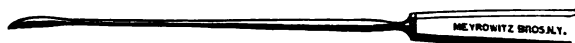
Etiology. Any systemic disease, acute or chronic, which seriously impairs the general health and leads to lowered tissue resistance will act as a predisposing cause of this affection. Local disease also of the integument of the canal—such as chronic eczema or a prolonged hyperæmia due to the irritating effect of a purulent discharge from the middle ear—makes it a fertile soil for the establishment of this disease. The exciting cause, there is little doubt, is some variety of micro-organism—usually the *staphylococcus aureus* or *albus*. These gain entrance to the sebaceous glands or hair follicles, or make their way into the deeper tissues through some accidental breach in the superficial layer—the result, very often, of some mechanical irritation, such as rubbing or scratching the ear—and then rapidly multiply.

Symptoms. Pain is the prominent symptom of the disease, and is usually most intense. In those cases in which the infection and ensuing inflammation are limited to the superficial layers of the integument the amount of pain present may be comparatively slight, but such cases are very exceptional. The degree of pain also varies at times with reference to the portion of the

canal in which the furuncle is situated. In the bony meatus, where the integumentary lining is thin, dense, and unyielding, the sensory nerve-endings suffer much more through inflammatory swelling than when it affects the looser tissue of the cartilaginous portion. Even in this latter situation, however, the pain is not rarely of such intensity that the appetite is lost, sleep is abolished, and the mental balance may be temporarily affected. General tenderness of the auricle is always present, and if the boil develops upon the posterior wall of the meatus the inflammatory redness and swelling may extend over the mastoid process and lead to a momentary suspicion of disease of this structure. The greater or less occlusion of the canal gives rise to a proportionate amount of tinnitus and deafness.

No attempt to introduce the speculum should be made until the auricle and orifice of the meatus have been carefully exam-

FIG. 105.



Furuncle knife.

ined without its aid. By one or the other method the furuncle can be seen projecting into the lumen of the canal, and there can scarcely be any possibility of mistaking its nature. Its broad base and general contour should prevent its being regarded as a polyp, and the probe will exclude any possibility of mistaking it for an exostosis.

Treatment. Should the nature of the disturbance be recognized in its earlier stage, previous to the formation of any distinct furuncle, the application of the artificial leech in front of the tragus or of a blister behind the ear may arrest its progress and lead to its resolution. In case, however, it is discovered that one or more boils are already in course of development, there should be no question as to the propriety of immediate incision. This need not be extensive, but it should be deep enough to secure free depletion and to give issue to any pus that may be

present. The immediate relief that is afforded by this measure should dispose of any objections to it that are grounded on the belief that it provides an increased surface for further infection. The rapid diminution of the swelling enables us to keep the wound clean and approximately aseptic, and the removal of the pus and the limitation of its further production lessen by so much the probability of an auto-infection. Should spontaneous rupture have occurred previous to the visit of the patient the opening, if small, should be sufficiently enlarged to permit of its complete evacuation. (Fig. 105.)

The cleansing of the canal may be effected by gentle syringing with warm sterile water, this being supplemented by a solution of hydrogen dioxide. When this is completed a 1 to 3000 bichloride solution is to be applied by means of the cotton-carrier to every accessible portion of the canal, and the ear then covered by a pad of sterilized gauze or cotton. This treatment should be repeated twice each day, if possible, until the acute symptoms have subsided. Poultices are objectionable because of their prejudicial effect upon the epithelial layer of the integument, whereby its power of resistance to germ invasion is lowered.

Upon the subsidence of the inflammation and the disappearance of swelling, steps should be taken to prevent any reproduction of furuncular formation. For this purpose some variety of mercurial ointment is of value—ung. hydrarg. nitrat. ʒj, ol. amygdalæ fʒj, or ichthyol, vaseline, lanolin āā ʒj. These should be daily applied throughout the whole extent of the canal for ten days or two weeks after the termination of the attack. Everything in the way of general treatment that will improve the health of those who display a tendency to recurring attacks of this disease will contribute to its prophylaxis.

Otomycosis.

This is a form of diffuse external otitis due to the growth within the canal of certain microscopical fungi. Those most fre-

quently responsible for the production of this disease are the *aspergillus nigricans* and the *aspergillus flavescens*, the former being the more common of the two.

Etiology. There is no one cause that will explain the implantation of this fungus within the meatus, but it seems that anything that exerts a depressing effect either upon the general vitality or upon the inherent protective power of the epithelial covering of the skin which lines the canal will favor its lodgement and growth. It is found with greater frequency in those of middle-age than in the young or old, and among the poor than among those in comfortable circumstances who live under better hygienic conditions.

Symptoms. Before the mass of material produced by the growth of the fungus has become sufficient to occasion obstruction of the canal and pressure upon its sensitive walls, the patient may complain of nothing more than some slight itching or burning within the meatus, and perhaps a sensation of fulness in the ears. Later, however, tinnitus and impaired hearing are added to the list of symptoms, and when the fungus has multiplied to such an extent that it becomes distinctly irritating and excites more or less inflammation of the meatal lining, pain in varying degree will make its appearance. This is apt to be of a sharp, lancinating character, and is at times very severe.

The appearances observed in the affected canal will vary somewhat with the length of standing of the disease. In the majority of instances the bony portion of the meatus will be found to have a coating of a loose, scaly nature, and if it be due to the growth of the *aspergillus nigricans* the surface of the mass will be sprinkled with blackish spots. The other variety of the fungus—the *aspergillus flavescens*—is characterized by a flaky coating which looks as though it had been dusted by a yellowish powder. When the fungoid growth has been present long enough, and has occasioned sufficient irritation of the canal walls to provoke some inflammatory secretion, the mass becomes moist and resembles

somewhat a cylinder of wet blotting-paper. (Figs. 106 and 107.)

Although but little difficulty usually attends the recognition of the disease, yet, as a precautionary measure against error, it is perhaps always well to resort to a microscopical examination of the foreign material. Enclosing in its meshes a number of squamous epithelial cells, we shall find a thick network of mycelium, and, in addition, numerous fruit stalks, these being cylindrical filaments containing septa or hyphæ and ending in a rounded fructification or fruit capsule. These terminations are comparatively large and very dark in color, or, on the other

FIG. 106.



Aspergillus. (HOLMES.)

FIG. 107.



Spores. (HOLMES.)

hand, are small and of yellowish hue, according to whether the fungus is of the *nigricans* or the *flavescens* variety.

Treatment. However thoroughly the canal may be syringed or vigorously mopped out with the cotton-applicator, its cleansing will be but partial. A greater or less number of microscopical spores will remain in spite of the most energetic use of mechanical methods of removal, and, therefore, we must supplement such methods by the use of some agent that will effect their destruction. Preliminary to the application of this, however, it will be advisable to spend a few days in reducing the irritative inflammation of the meatal integument that we are apt to find in most

of these cases. Ordinary sedatives and astringents will usually quickly accomplish this. A 1 to 2000 alcoholic solution of mercury bichloride may now be instilled into the canal, the patient reclining upon a couch, with the affected ear uppermost, until it is filled. Either absolute or dilute alcohol may be used, according to the amount of burning pain produced. This solution should be permitted to remain in the ear for some ten or fifteen minutes, and its application should be repeated two or three times a day for several days, and occasionally afterward for about two weeks, in order to completely destroy the spores and prevent any reappearance of the disease. Another remedy that is of much curative value is salicylic acid in 2 per cent. alcoholic solution.

Foreign Bodies in the External Auditory Canal.

The discovery of foreign bodies within the external meatus is of very frequent occurrence. They may be animate or inanimate, and they may either originate within the canal or enter it from without.

Those which arise from within are usually of the nature of accumulations and may consist of inspissated cerumen, of a compact or laminated mass of desquamated epithelial cells (*keratosis obturans*), or of a combination of cerumen and epithelium with a large proportion of hairs from the tragus and outer portion of the meatus. Not infrequently, also, the scanty purulent discharge from a sluggish otorrhœa may remain within the canal, undergo inspissation and hardening, and form a plug of dense consistence.

A great variety of objects may enter or be introduced into the ear from without. Different kinds of insects may make their way into the canal, generally during sleep, or inanimate objects may be intentionally pushed within a child's ear either by himself or by one of his playmates.

Inspissated Cerumen.

Accumulations of this secretion are not always due to the same cause. In a certain proportion of cases some alteration in the character of the cerumen is responsible for its retention. In others the curvature of the canal may depart so far from the normal as to offer a mechanical hindrance to the escape of the secretion. Finally, and probably in the majority of cases, it is the result of ill-advised attempts on the part of the patient to cleanse the canal by means of some one of the various implements that are largely sold for this purpose. These too often defeat the end that they are intended to serve by pushing inward the cerumen instead of assisting nature's methods of removing it.

Symptoms. It is often surprising that so few symptoms may attend the presence within the canal of very large and hard masses of cerumen. Such plugs may be present for long periods of time, during which, if a minute channel remain for the passage of the sound waves to the drumhead, the patient may remain quite unconscious of their existence. If, however, this channel becomes closed or the mass be forced against the tympanic membrane, symptoms immediately develop which prompt the patient to seek relief. These are usually a sudden deafness, with perhaps a sensation of fulness in the canal or of pressure upon the drumhead. This pressure, being transmitted through the ossicles to the labyrinthine fluids, may readily occasion vertigo and at times hallucinations of hearing. The patient will often complain of the reverberating sound of his voice, it sounding to him as though he were "talking into a barrel." In exceptional cases a very hard and dry plug may sufficiently irritate the canal walls to provoke some pain.

Diagnosis. Though at first some little uncertainty may attend the recognition of impacted cerumen, a very little experience should suffice to make its diagnosis a matter of comparative ease.

If there is no thick growth of hair about the tragus to obstruct the view, we can very often discover the plug by simply drawing the auricle upward and backward. If the mass be detected in this way almost at the orifice of the canal, it certainly should not be mistaken for the drum-membrane, even if its presenting surface be polished and of a somewhat glistening appearance. The gentle use of the probe will be of service in banishing any doubt. In case, however, that the plug is too deeply situated to be seen by the unaided eye, the introduction of the speculum becomes necessary. Some care should be observed in the employment of this instrument lest it lead us into error. If, for instance, it be not accurately directed in the course of the canal, a slight smear of wax upon the wall may be mistaken for a completely occluding plug. It has often happened, also, that the shining face of a deeply sunken mass of cerumen has been thought to be the membrana tympani. The absence of the handle of the malleus as a feature of this supposed membrane, however, should apprise one of this blunder, and a further test will be found in the application to it of a moistened tuft of cotton upon the tip of a probe. The yellowish discoloration of the cotton that will be obtained in this way will at once reveal the deception.

Treatment. For several excellent reasons syringing of the canal with warm water is the best method for the removal from it of a mass of impacted cerumen. If skilfully used the syringe will usually empty the canal much more quickly than if other instruments be employed; even in unskilled hands it is scarcely likely to inflict the least injury; and finally, from the patient's point of view, it is decidedly the least unpleasant method that can be adopted. To facilitate the removal of the plug in case it be very hard and rather firmly adherent to the walls of the canal, a very useful preliminary to the employment of the syringe will be the instillation within the canal of some solution that will soften the mass and loosen its attachment to the integument. A moderately dilute solution of hydrogen dioxide is very effec-

tive for this purpose, or the patient may be given this solution—*sodii bicarb.* gr. xx, *glycerin* ʒj, *aquæ* ʒj—and told to put a few drops of it in the canal several times a day, retaining it for some minutes each time, and to return in two or three days for the syringing. The most satisfactory form of syringe is one of two or three ounces capacity, having a glass barrel and a long, tapering nozzle. The hard-rubber cap at each end should be removable and the piston packing be of asbestos, so that the whole instrument can be easily and thoroughly cleansed and sterilized. The length and slenderness of the nozzle enable the surgeon to see distinctly the position of its tip and to direct with accuracy the stream of water. Some form of receptacle must be used to catch the water as it flows from the ear. Various styles of basins

FIG. 108.



Ear spout with waste pipe.

are in common use, but these must all be held by the patient, and, as his hand is apt to be rather unsteady than otherwise, their contents are too liable to be spilled by any sudden movement upon his part. A far more convenient and cleanly device is the spout-shaped cup which can be hung upon the auricle by a wire loop. At its lower extremity is an outlet to which is attached a rubber tube of suitable length, and through this the waste fluid is conveyed to a cuspidor or other vessel upon the floor. (Fig. 108.)

The water used is always to be heated to an agreeable temperature, and the stream from the syringe should be directed around the borders of the plug rather than at its centre. By doing this the mass is much more readily detached from the walls of the canal, and its emergence will be favored by the return flow of the fluid. It is always well to straighten the canal as much as possible by the usual upward and backward traction upon the auricle. No more than a moderate amount of force should be employed in injecting the water, not only because it is uncalled

for, but because any excess of force may occasion some vertigo in the patient or perhaps inflict some injury upon the drumhead. Upon the escape of the plug the meatus should be gently mopped dry by means of the cotton-carrier, and should its walls be excoriated or inflamed to any noticeable degree a soothing and protective ointment may be applied to them, or a powder of boric acid and zinc oxide insufflated. For several hours also a pledget of cotton should be worn in the meatus, in order that the newly exposed and sensitive lining may not be chilled.

In those somewhat exceptional cases known as *keratosis obturans*, in which the plug is principally made up of desquamated epithelium, the syringe will often prove of itself unable to effect its expulsion. In this event we are compelled to resort to other instrumental aid. Blunt curettes and appropriate forceps will generally enable us to gradually break up the dense mass and to remove it in fragments, but the greatest possible care should be observed in doing this, and no one should attempt it who cannot enjoy to the fullest extent the advantage afforded by the head-mirror, or who does not possess the delicate skill that is absolutely essential to the safe employment of these instruments. Used in conjunction with them, the syringe is of value in softening the epithelial plug and making its instrumental disintegration and removal the more easy.

Foreign Bodies.

The misguided playfulness of children, the pranks that they are apt to play upon one another, are responsible for the introduction of an infinite variety of foreign bodies within the auditory canal.

Of the many inanimate objects that are frequently inserted, a certain number—such as smooth beads, round buttons, or cherry-stones—are quite unirritating and do no harm so long as they are allowed to remain unmolested by rough or awkward attempts at removal. Another variety of object, however, while being

primarily equally as unirritating as those just mentioned, is yet apt to undergo, as the result of the heat and moisture of the meatus, germination, and growth, or possibly mere swelling. This is the objectionable feature of such bodies as peas, beans, coffee berries, or different kinds of seeds. Finally, we have a long list of insects and bugs that may fly or crawl into the meatus, particularly during sleep.

Symptoms. The symptoms that attend the presence of a foreign body within the meatus will vary in their aggressiveness with the amount of irritation and obstruction that are occasioned by it. If it happens to be smooth and round, if it has been introduced without force, and is not of sufficient size to completely fill the canal, it may give rise to no symptoms whatever, and may perhaps remain entirely inoffensive for years. If, however, all these conditions are reversed we will assuredly have more or less inflammatory disturbance, pain, and deafness.

If the insertion of the body has been of recent occurrence there can be little or no difficulty in its discovery. With the speculum and head-mirror at our disposal there is no need of a history. Even with these to aid us, however, if sufficient time has elapsed to permit of much inflammatory swelling of the canal, or if the body has become coated with cerumen or any tympanic discharge that may be present, we may have considerable difficulty in discovering or in recognizing it.

Treatment. There is scarcely anything in the whole range of ear work that will so severely test the skill and discretion of the aural surgeon as the removal under unfavorable conditions of a foreign body from the external canal. Lightness and steadiness of hand, infinite patience, and excellence of judgment must all be combined if he would avoid not only failure, but perhaps the infliction of serious injury to the contiguous structures. Even though one be possessed of all these attributes, resort to instrumental delivery should never be made until the syringe has proved ineffective. In the very large majority of cases, how-

ever, the syringe, if properly used, will be successful. Where there is no impaction of the body, and the canal has not been wounded and inflamed by previous crude attempts to empty it, there can be little else to interfere with the washing out of the body by ordinary warm water syringing. Straightening of the canal should be effected by traction upon the auricle, and the stream of water then directed not *at* the body, but between it and the canal wall. In those children who are either timid or combative—and, unfortunately, there are many of them—it is not infrequently necessary to employ an anæsthetic, in order that the syringing may be properly conducted. Should it fail, however—as, in spite of skill and perseverance, it sometimes will—we can now with a clear conscience resort to one or more of the several instruments that have been devised for such emergencies.

The blunt ring-curettes, slender hooks, and delicate needle-toothed forceps that are at our service will seldom fail in skilled hands to extract the foreign body. The fact, however, that even the expert must use the utmost care and caution in the employment of these instruments, should be sufficient to deter any thumb-fingered apprentice from rushing in where the trained otologist would tread with becoming fear.

When an insect has made its way into the ear it is best, before attempting its removal by the syringe or forceps, to first destroy it by instilling oil into the canal. Where the foreign body is of such size as to completely fill the lumen of the canal and to prevent the passage beyond it of any instrument that might effect its removal, an old device that has recently been rediscovered may be adopted. It consists in moistening the tip of a camel's-hair brush with glue, applying it to the body in the canal, and allowing it to remain until the glue has set. When this has occurred the two may often be removed together. It is essential to dry the body thoroughly before placing the brush in contact with it.

In the rare event that, in spite of all the surgeon's skill and ingenuity, the body persists in remaining within the canal, it may become necessary in order to prevent the development of severe inflammation with possible extension to vital structures, to reach and remove the object by detaching the pinna and posterior portion of the cartilaginous canal.

CHAPTER XVII.

DISEASES AND INJURIES OF THE MEMBRANA TYMPANI AND TYMPANUM.

Myringitis—Acute and Chronic.

THAT this can occur as a distinct disease is vigorously denied by many otologists. Clinically, however, it is convenient to admit its possibility, for cases occasionally occur in which inflammatory involvement of the membrane is so marked, while accompanying disturbance of the tympanum itself or of the external canal is so insignificant, that the affection of the drumhead seems to constitute the sole pathological event. It is usually occasioned by the direct application of some form of irritant, cold air or water being at times to blame, while at others very hot water or oils have produced it.

Symptoms. It is the disproportionate mildness of the subjective symptoms attending this disease, as compared to the marked objective changes in the appearance of the drumhead, that largely justifies us in classifying the affection as a disease in itself. When well established, inspection will usually reveal very deep congestion of the membrane, but no bulging or other indication of the presence of fluid in the middle ear. The lining of the adjacent portion of the canal will be found very slightly flushed, if at all. Although pain may be sharp and stinging at times, it is commonly but moderate in degree. Deafness and tinnitus are also much less evident than one would be led to expect by the findings of his examination with the speculum. Infiltration and thickening of the drumhead attend the progress of the inflammation, and rapid desquamation of the dermoid epithelium being added to the serous exudation will lead to a purulent film or coat-

ing upon the membrane. Beneath this, superficial or deep erosions may occur and it is not impossible that ulcerative perforation of the membrane from without inward may take place. If the membrane be cleansed it will be found to have a roughened or granular appearance, and a minute abscess or two may be discovered in its deeper layers. These will usually rupture spontaneously, leaving shallow ulcerations. If the disease becomes chronic the inflammatory reddening of the drumhead gradually acquires a darker hue, the suppurative process continues with lessened activity, and granulations of varying size will gradually develop.

Treatment. Although in these cases the mucous membrane of the middle ear and Eustachian tube may not share at all in the acute inflammation of the drumhead, yet it is probable that there is always more or less chronic catarrh of them. Thorough cleansing of the nose and postnasal space may, therefore, have some restraining influence upon the intensity of the inflammation, and, in addition, we may mop the tubal orifice with some glycerite of tannin. Externally, in case the disease displays a more than ordinary activity, the application of the artificial leech in front of the tragus will be of value, and we may also paint some tincture of iodine back of the auricle. The treatment of the membrane itself will consist of careful cleansing by means of the cotton-carrier, and this will be followed by the gentle insufflation of a powder composed of equal parts of zinc oxide and boric acid. A little morphine may be added to this if pain should be at all severe. If instead of entirely subsiding within a few days the disease should display any tendency to chronicity, and if this be evidenced by the development of minute ulcers or granulations upon the membrane, a light brushing of these with a 10 or 20-grain solution of silver, repeated a few times, will usually suffice to bring the disease to a close.

During the acute stage of the disease the administration of an active laxative and some temporary restriction of the diet will be

apt to have a happy effect in restraining the energy of the inflammation.

Injuries of the Membrana Tympani.

Perforations of the membrana tympani as the result of traumatism are of quite frequent occurrence. The reprehensible habit among ignorant people of punishing children by boxing their ears is often responsible for this injury. Analogous to this is the effect of sudden condensation of the air in the outer portion of the ear by violent explosions. The wound of the membrane is probably due in the larger number of cases to direct violence exerted by the forcible entrance into the external canal of some foreign body. There is nothing to be gained by an enumeration of the many and wide variety of articles that have occasioned this injury. They may enter the canal by accident or be introduced by design. Again, in a considerable number of cases in which atrophic or degenerative changes of the tympanic membrane have been present, its rupture has been occasioned by violent paroxysms of coughing or sneezing. A sudden and overvigorous blowing of the nose has also been known to produce a perforation, and, through the same mechanism, too forcible inflation of the middle ear, either by the Politzer bag or the catheter, has had a similar effect. In the event of rupture having been caused by a violent explosion in the immediate neighborhood of the ear, it will usually be found that some catarrhal or other obstruction of the Eustachian tube has been an accessory factor in the accident through its interference with the normal ventilation of the tympanum.

The appearance and situation of ruptures of the tympanic membrane will depend upon the manner of their production. When resulting from direct violence they will most often be found in the anterior half of the membrane. The general shape of the wound will conform more or less closely to that of the instrument or article that has inflicted it, and whether its edges

be smooth or ragged will also be influenced by the same circumstances. A moderate amount of hemorrhage will usually be provoked by the accident and the blood will be found about the margin of the wound and perhaps occupying a portion of the canal. In case of much injury to the inner wall of the tympanum with perhaps coincident infection, a suppurative median otitis will be a highly probable, if not inevitable, outcome. The rupture that is caused by indirect violence is, as a rule, round or oval in shape, and its edges are apt to have a gaping appearance. It is most often located in the posterior half of the membrane, and if oval its direction usually corresponds to that of the radiating fibres of the median layer. Hemorrhage is commonly less than in the wound due to direct violence. If the perforation has been caused by a severe fall or blow upon the ear, symptoms of labyrinthine concussion—such as deafness, giddiness, and tinnitus—may ensue. The deafness that denotes this complication is not only severe, but it is, in a large proportion of cases, permanent.

Treatment. It is best to trust largely to nature to repair these ruptures of the membrane and to meddle as little with her methods as possible. Less harm is apt to follow the rendering of too little assistance by the surgeon than the display of any officious zeal on his part. If the wound has resulted from indirect violence it should be protected from external contamination by placing a barrier of absorbent cotton in the meatus. If any quantity of blood is found in the deeper portion of the canal it may be gently mopped out by a tuft of sterile cotton upon an applicator, and afterward some stearate of zinc combined with a small proportion of iodoform insufflated. In simple wounds of this nature there is no occasion whatever for syringing the ear or for the instillation of drops of any kind. On the contrary, they are apt to prove more of a hindrance than a help to cure, and they should be rigidly avoided. It will be judicious, however, to cleanse the nose and nasopharynx two or more times daily with the Dobell solution.

When it is direct violence that has occasioned the perforation and there has been some coincident injury of the inner wall of the tympanum, steps should be taken to prevent or minimize any ensuing inflammation. The gentlest cleansing of the canal and membrane with sterile cotton, thorough washing of the nasal and postnasal cavities with the Dobell spray, the application of iodine back of the ear, and a light pad of absorbent cotton over the meatus—all these measures should be employed, and, in addition, a laxative should be given and the food supply reduced. If in spite of these prophylactic measures inflammation of the membrane and of the middle ear should develop, its treatment will be that of acute median otitis.

Acute Inflammation of the Middle Ear.

Inflammation of the mucous membrane lining the tympanic cavity may be either of a simple catarrhal character or it may be purulent. Diseases of the tympanum comprise fully two-thirds of all the diseases of the ear. Under normal conditions the tympanum is an aseptic cavity, and it is extremely infrequent that disease originates within its boundaries. In an overwhelming percentage of cases the primary seat of disease is to be found in the nose and nasopharynx, and from here it makes its way, by direct continuity of the mucous membrane that lines them all in common, up the Eustachian tube to the chamber of the middle ear. It is the well-equipped rhinologist, therefore, who holds the key to the prophylaxis of the majority of affections of the tympanum. Direct treatment of this cavity itself through the external canal may be of assistance in alleviating and abbreviating its diseases, but complete and permanent cure can only be conferred by him who has, in addition, the ability to restore and maintain the health of the nose and nasopharynx. The pathological conditions of these latter two cavities that are most likely to extend to and implicate the middle ear have already been described under their appropriate headings, and it is scarcely

necessary now to emphasize the fact that it is these which should receive the lion's share of treatment, even when they have become equally well established in the tympanum.

Although, for the purpose of clinical description, acute inflammation of the middle ear is classified under the two headings of simple catarrhal and purulent, yet it is to be remembered that the two divisions are but different pathological degrees of the same disease process. Since, therefore, the progress of the one will eventuate in the other, it frequently happens that at our first examination of a median otitis we are unable to reach an immediate decision as to with which of the two we have to deal.

Acute Catarrhal Otitis Media.

Etiology. With a perfectly healthy nose and nasopharynx it is extremely doubtful if many of the causes to which this disease is commonly attributed would prove operative. Chilling, as the result of a wetting or a prolonged exposure to cold, sea-bathing, and dentition might prove sufficient to produce a moderate congestion of the tympanic mucous membrane, but it would probably soon subside and leave no trace. An acute rhinitis, however, particularly if it be of an infectious nature, such as that of influenza or grippe, is a very frequent and active cause of median otitis. Similarly, it is an almost constant accompaniment, in varying degrees, of the rhinopharyngitis that attends the exanthemata, typhoid fever, pertussis, and pneumonia. Another one-time prolific cause, though now, happily, a much less frequent one, is the entrance of various solutions into the middle ear as the result of their use in the original and now antiquated form of the nasal douche.

Symptoms. The earliest sensations of discomfort are often referred to the nasopharynx and to that side of it corresponding to the affected ear. A feeling of fulness or of dull pain over the course of the Eustachian tube is of usual occurrence, and this is apt to be aggravated by the act of swallowing. In a few hours

the pain will have usually extended to the middle ear and have become lancinating or throbbing in character. The ear will have a stuffy or stopped-up sensation, and there will be evident, though perhaps not marked, impairment of hearing. Different forms of tinnitus of varying degrees of loudness commonly accompany the inflammation, and deep-seated tenderness upon pressure below the auricle is obtainable. The pain almost always increases in severity toward night and may radiate from the ear toward the teeth or upward and backward over the side of the head. In children, particularly, there is apt to be a greater or less elevation of temperature accompanied by certain nervous phenomena, such as delirium or even convulsions.

The examination should not be limited to the meatus and tympanic membrane, but should include a careful inspection of the nasal and postnasal cavities. These latter will almost invariably be found to be the seat of an acute or subacute catarrhal process which has been but the precursor and cause of that which has secondarily involved the tube and tympanum. When the rhinoscopic mirror can be successfully employed the tubal orifice will be seen to be flushed and swollen and occluded by a mass of viscid, glairy mucus.

In cases of average severity the congestion of the drumhead is apt to be most pronounced over that portion of it known as Shrapnell's membrane, and there is also an extension of it downward along the handle of the malleus. When the attack is more severe, not only the periphery, but perhaps the whole membrane shares in the deep redness that attends the vascular engorgement. The handle of the malleus may be entirely obscured, and the only recognizable landmark that this ossicle may afford will be the short process which appears as a pale pink or yellowish-white point. Should there be any material amount of serous exudation within the tympanum, its escape by way of the Eustachian tube being prevented by reason of the catarrhal swelling of the tubal mucous lining, it may occasion a noticeable

bulging of the postero-inferior quadrant of the tympanic membrane. This, however, is not of frequent occurrence.

The diagnosis of the affection can present no difficulty. The character of the pain may perhaps suggest neuralgia, but inspection of the drumhead will at once dispose of this supposition.

Treatment. From what has been said concerning the etiology of the disease it logically follows that treatment of the primary disturbance within the nose and nasopharynx should take precedence of that directed to the ear itself. A merely perfunctory sort of spraying of the nose with Dobell's solution or liquid petrolatum, which is all that many otologists seem to think necessary, is by no means sufficient. The cleansing of this cavity and of the postnasal space should be most thorough. If necessary to the complete removal of the thick mucopurulent secretion that is usually encountered, the lower and middle turbinates should be reduced by brushing them with a 4 per cent. solution of cocaine upon the cotton-carrier. The alkaline spray is then used, perhaps several times, and, in addition, a generous tuft of cotton upon the applicator is saturated with the same solution, carried through the nose back to the nasopharynx, and its vault and posterior wall gently but persistently mopped until they are freed from the thick coating of tenacious mucus that is invariably found covering them. By giving the tip of the applicator the curve of a Eustachian catheter the lateral walls may also be cleansed and the plug of mucus obstructing the tubal orifice removed. If now the same procedure be repeated with some glycerole of tannin upon the applicator, and if this be followed by the spraying of an oily solution, such as that of Douglas, we shall probably have made the nose and nasopharynx as approximately aseptic as we are ever apt to find them. After so thorough a cleansing and medication as this, no reasonable objection can be urged against a gentle inflation of the middle ear by the Politzer method. The hypothetical danger of infecting the tympanum by forcing pathogenic organisms into it in this way through the

Eustachian tube has been minimized, if not entirely removed, and the good that will be accomplished by overcoming the tympanic vacuum and reducing the pressure and mechanical hyperæmia for which it is responsible, will be vastly in excess of any possible harm that may result. The use of the catheter for this purpose is to be deprecated, not only because, as a rule, it is unnecessary, but because it is extremely apt to prove irritating to the inflamed and oversensitive pituitary and tubal mucous membrane.

It is probable that what may be termed the external treatment of the ear has some mildly palliative effect upon the course of the intratympanic inflammation, but of curative action it has none.

FIG. 109.



Artificial leech.

Cases of catarrhal otitis media that receive the thorough nose and throat treatment that I have described will almost invariably recover without anything further in the nature of local therapeutics. It will at least do no harm, however, to apply the artificial leech in front of the tragus, to paint iodine back of the auricle, to gently syringe the canal every few hours with a warm boric-acid solution, and during the intervals to keep a hot-water bag or some other vehicle of dry heat against the ear. I have very little faith in the relief that is said to be afforded by the instillations into the meatus of solutions of morphine, atropine, or cocaine. Their mere contact with the inflamed drumhead is of no more value than that of so much water, and the amount of

the medicament that is absorbed by the cutaneous surface is homœopathically infinitesimal.

The activity of the inflammation may be very greatly diminished, however, by the employment of certain systemic measures. The one of first importance is the administration of an active laxative. Subsequently the exhibition of aconite in small and frequently repeated doses will subdue the arterial excitement, and if symptoms of nervous disturbance are manifest, bromide of potassium will best control them. The diet should of course be restricted, and if the patient will remain in bed for a day or two it will materially hasten his recovery.

Upon the subsidence of the attack it will be advisable to repeat the Politzerization of the middle ear a few times, not only to restore the normal patency of the Eustachian tube, but to prevent any of the occasional sequelæ of the inflammation, such as adhesions of the membrana or stiffening of the ossicular joints. Since, also, one attack of this kind predisposes to others, there should be no avoidable loss of time in removing from the nose and nasopharynx any of those obstructive or chronic catarrhal conditions that so greatly increase the patient's liability to secondary tympanic inflammation.

It has been advised by more than one author that in case of the existence of adenoid growths they be at once removed, even during the continuance of the otitis. This I think is not only unnecessary to the cure of the aural disturbance, but, through the addition of a reactive inflammation to that already present, may, by intensifying the latter, lead to its transformation into one of a purulent character.

Acute Purulent Otitis Media.

In the absence of treatment, or perhaps as the result of injudicious treatment of a simple catarrhal median otitis, this may be converted into one of a purulent type. Infection of the middle ear by the entrance through the Eustachian tube of one or more

of the several forms of pyogenic organisms is, of course, the invariable precedent of the suppurative process. Those most often concerned in the production of this disease are the pneumococcus of Fränkel, the streptococci, and the staphylococci. Their success in establishing suppuration will depend very largely upon the state of the patient's general health and upon the degree of resistance possessed by the tympanic mucous membrane. A number of previous attacks of catarrhal inflammation will have materially reduced its capacity for self-protection, and have rendered it an easy mark for the pus-producing organism. Several of the general febrile diseases act as exciting causes of purulent otitis. Scarlatina, measles, and diphtheria act in this way with particular frequency in children, and for this reason it is extremely important that the ears should be repeatedly inspected during the continuance of these diseases, and that cleansing and antiseptics of the nose and nasopharynx should receive the closest attention of the physician. In adults, influenzal and grippal attacks are most often responsible for a complicating purulent inflammation of the tympanum, and, therefore, in these diseases as well the nasal and postnasal cavities should receive the same active prophylaxis. Typhoid fever, pneumonia, and acute nephritis are also accompanied at times by this complication, all of them being commonly attended by inflammatory involvement of the nasopharynx. Perforation of the drumhead with coincident infection of the middle ear as the result of the introduction of foreign bodies into the meatus or of unskilful attempts to remove them, is not infrequently followed by suppurative inflammation.

Symptoms. The symptoms that characterize this disease differ from those of the simple catarrhal otitis, chiefly in their greater intensity and in the greater amount of systemic disturbance that accompanies them. The agonizing pain that precedes spontaneous rupture or delayed paracentesis of the membrana baffles description. The impairment of hearing is much more pronounced, the

tinnitus louder and continuous instead of intermittent, and the sensations of fulness and throbbing in the affected ear more distressing. Systemic participation in the disease is manifested at times by considerable elevation of temperature, constipation, entire loss of appetite, insomnia, and very often nervous disturbance, such as delirium, or, in children, convulsions.

Examination of the ear discloses a tympanic membrane so uniformly and intensely congested that all its anatomical features are obliterated. In addition to this alteration of its appearance, there is a corresponding change in its position due to the filling of the tympanum with an inflammatory and, in this case, purulent secretion. Instead of the normal outward presenting concavity of the drumhead, we find a distinct bulging convexity of it which is particularly marked, as a rule, in its posterior half.

If a policy of non-intervention be adopted the collection of pus within the cavity increases in quantity, pressure upon its outer membranous wall becomes steadily greater, and when it seems that the limit of the patient's endurance has been reached, spontaneous rupture of the abscess suddenly occurs, tension is relieved, and the symptoms, both local and general, at once subside. Three or four days are usually required for this unassisted evacuation to occur, and during this period of waiting upon nature the patient is not only subjected to tortures that must be experienced to be appreciated, but he is exposed to all the danger to life and risk of permanent injury that may attend the extension of the disease to neighboring structures. The mastoid antrum and cells will almost inevitably be seriously involved as a consequence of this delay, and other complications that occur with lamentable frequency are facial paralysis, meningitis, pyæmia, and septicæmia, thrombosis of the lateral and perhaps other sinuses, extensive necrosis of the temporal bone, attended at times by hemorrhage from the carotid artery or jugular vein, and, finally, epidural or cerebral abscesses. The facility with which meningitis may be occasioned is explained by the close anatomical

relation that exists between the tympanic and cranial cavities through the medium of the petroso-squamosal suture. In infancy, previous to the closure of this fissure, a duplicature of the dura mater projects through it into the tympanum and blends with the mucoperiosteal lining of that cavity; and later in life, although this gap is obliterated, the vascular connection between the two membranes remains.

The point at which spontaneous rupture of the tympanic abscess occurs is usually in either the lower anterior or posterior quadrant of the drumhead. In case, however, the greatest violence of the inflammation has been manifested within the attic it is here that pus will be found in greatest amount, and it is in the *membrana flaccida* or Shrapnell's membrane that pointing and perforation will take place. Although the ensuing discharge may at first be of a seropurulent character, it very soon becomes distinctly purulent. Under exceptionally favorable circumstances, concerning chiefly the general vitality of the patient and the extent to which the disease has invaded the cavities contiguous to the ear, the discharge will gradually diminish, and within probably two or three weeks it will entirely cease and permit of the cicatrization of the perforation. So gratifying a termination of the attack is rare, however, for prolonged retention of the pus within the middle ear is almost always provocative of destructive processes in that cavity, which leave permanent disability and tend to prolong the suppuration indefinitely. Even when spontaneous perforation has occurred very early in the attack, however, the passing of the acute into a chronic process is, in spite of it, very apt to happen in those cases that have been secondary to attacks of the exanthemata, of diphtheria, or of influenza. In instances such as these the tympanic inflammation is apt to be particularly intense and virulent, and unless evacuation and free drainage of the cavity are effected with exceptional promptitude, extensive destruction of the ossicles and walls of the tympanum becomes highly probable. This result is also greatly favored by a

depraved condition of the patient's general health and by the existence of the strumous diathesis, or of any tuberculous tendency.

As affecting prognosis, we must be aware of the possibility that, after the arrest of all active symptoms of the disease, the subsidence of the discharge and the closure of the perforation of the membrana, certain of its effects may be of later appearance and prove of permanent duration. For instance, if during the stage of decline of the inflammation and the establishment of the reparative process the eroded surfaces of the membrana and of the inner wall of the tympanum are permitted to come and remain in contact for any material length of time, more or less extensive adhesions of them are almost certain to form. These will of course lead to immobilization of the ossicles, to depression and fixation of the foot-plate of the stapes within the fenestra ovalis, and to the evolution of the series of symptoms that are occasioned by increase of labyrinthine pressure. Progressive impairment of audition, increase of tinnitus, with perhaps the addition of vertigo, are common results of these alterations in the sound-conducting apparatus. Even in the absence of adhesions of the drumhead the ossicular articulations may become ankylosed, or there may occur thickening or atrophic changes of or calcareous deposits in the membrana that will at times seriously interfere with its functional activity. Finally, in the event of the extensive or complete destruction of the membrana and ossicles it is the injurious effect upon hearing that will be the principal result. The symptoms that arise from extension of the suppurative inflammation to the mastoid cells and to the cranial cavity will be considered later.

Diagnosis. Previous to perforation of the membrana and the escape of the contents of the tympanum, no positive diagnosis can be made between an acute simple and an acute purulent inflammation of the middle ear. A severe attack of the former and one of average severity of the latter are so nearly alike in the

symptoms they produce and in the changes they effect in the appearance of the drumhead that there can be no certain differentiation between them. Inflammation that is limited to the membrana—myringitis—should not lead us into error, for the pain that attends it is comparatively trifling and the reduction of hearing power but moderate. A semblance of bulging may be occasioned by the presence upon the membrana of blebs or vesicles, but good illumination and close scrutiny should make their recognition easily possible. Upon incision or spontaneous rupture of the membrane the character of the ensuing discharge will at once reveal the nature of the disease. In case rupture has already occurred when we first examine the ear, the canal and membrane are to be thoroughly cleansed by means of sterile cotton upon an applicator, and the perforation then searched for. Should there be any difficulty in its discovery, auto-inflation of the ear by the Valsalvian method, the membrane being at the same moment under inspection, will usually enable us to locate the breach. Perforations in Shrapnell's membrane are now and then extremely minute and may for a time escape detection.

Prognosis. In uncomplicated cases of acute purulent otitis media the treatment of which we have been able to assume early in the attack, and in which the general health of the patient is of average excellence, the prognosis will, as a rule, be favorable. Such cases are usually the outcome of an acute exacerbation of a chronic nasal and nasopharyngeal catarrh, and, upon the control of the primary, the secondary disease will almost always quickly yield to appropriate treatment. When, however, the otitis is consecutive to diphtheria, to measles, to scarlet or typhoid fevers, or when the patient is a syphilitic or is the subject of strumous or tuberculous taint, the prognosis will be doubtful if not distinctly unfavorable. The purulent middle-ear inflammation that is so frequently associated with influenza and grippe is notoriously virulent and apt to eventuate in destructive processes that will leave permanent disability. Under any circumstances, regard-

less of etiological factors, one or more of the following list of symptoms will influence the prognosis very much for the worse : A loud and incessant tinnitus ; severe pain, which persists after the opening of the abscess and the escape of its contents ; profuse suppuration, which does not diminish under treatment ; the presence of granulations or polypi, which usually spring from areas of carious bone ; extensive destruction of the membrana and ossicles ; evidences of mastoid involvement ; facial paralysis and inflammation of the cervical glands.

Treatment. In this variety of median otitis, as in the simple catarrhal form, the treatment of the nose and nasopharynx should completely overshadow that of the ear itself. Pathologically, these two cavities are one, and it is in this catarrhal bridal-chamber that pathogenic organisms are multiplied in countless numbers. Each frequently recurring physiological opening of the Eustachian tube offers them easy passage to the middle ear, and when they have arrived there and made their declaration of war, what possible chance have the inherent protective powers of the tympanic mucous membrane to successfully meet and destroy them, to drive them back whence they came, if their ranks are to be constantly reinforced by legions of others from the diseased nose and nasopharynx ? Nothing could be more distinctly apparent than the absolute necessity for thorough cleansing and disinfection of these unclean upper air passages, in order that this active germ reproduction shall be speedily stopped. If the measures we adopt are applied with sufficient frequency and energy to accomplish this, the inflammatory swelling and closure of the Eustachian tube will soon be overcome and its reopening will permit the pus-filled tympanum to empty itself through its natural outlet. And yet we are told by a distinguished otologist, in a recently published text-book on the diseases of the ear, nose, and throat, that "any active treatment of the nose and nasopharynx during an attack of purulent median otitis is to be avoided." And we have but to turn the page to find that "in any case of

acute purulent discharge" we are enjoined to "let the ear run and drain itself through the *natural* drainage-tube, the *external auditory canal*!" It is to be hoped that such a misconception of what constitutes the natural drainage-tube of the tympanum is not widely prevalent among otologists.

The same treatment of the nose and throat that I have advised during an acute catarrhal median otitis should be carried out in this purulent form of the disease with increased rather than lessened assiduity. The more quickly we succeed in restoring the patency of the Eustachian tube the less probable need will there be for nature or ourselves to provide an artificial channel for the relief of the overfilled tympanum. If, however, it be our misfortune to first see the ear so late in the course of the disease that no postponement of surgical interference can be permitted—if the patient be almost mad with pain, if the bulging of the membrana be so great as to threaten imminent rupture—it is our imperative duty to incise the drumhead without the loss of an unnecessary moment. If, on the other hand, the patient has sent for us a day or two or even some few hours previous to the arrival of this critical moment, we may in some instances avert the necessity for incision of the membrane by prompt and proper treatment. All the measures, general and local, that have been detailed for the management of the simple catarrhal inflammation will be of value in this. Since the necessity for re-establishing tubal drainage is more urgent, however, we may employ an additional remedy that is now at our service. After the preliminary cleansing of the nose and postnasal space and the cocaineization of the turbinates and Eustachian orifice, a 1 to 2000 solution of adrenalin should be carried to the entrance of the tube by means of a cotton-tipped applicator having a properly curved extremity. Allowed to remain in contact with this point for a few moments, it will be followed in two or three minutes by marked shrinkage of the swollen mucosa, the escape of a quantity of viscid mucus or muco-pus from the lumen of the canal, and in not a few cases

by the issuance of more or less pus from the cavity of the middle ear.

With the tubal swelling reduced to this extent but little force will be required to reopen the tube in its entirety by the Politzer bag or the catheter ; and with the use of either, if the head be tilted forward and to the side opposite to that of the affected ear the escape of the inflammatory contents of the tympanum will be greatly favored. It is not impossible that in this way the necessity for incision of the membrana may be safely postponed, if not altogether averted. Those who advocate the immediate incision of the drumhead the moment that there is any reason to suspect the presence of an intratympanic exudation are liable at times, in spite of the most rigid antiseptic precautions, to convert into a prolonged purulent process what, with a little patience, might have ended as a simple catarrhal one. At the risk of uncalled-for reiteration, I repeat that in the presence of such pressure upon the membrana as makes its eventual spontaneous perforation inevitable, the knife should give immediate exit to the imprisoned fluid ; but I am not yet ready to consider justifiable the employment of artificial puncture previous to this period as a merely antiphlogistic measure. With no disposition to belittle the possible dangers that attend the prolonged retention of pus, I still think that our faith in nature is very often withdrawn too soon, and that however great the immediate relief due to our intervention may seem, it is too often gained at the expense of much subsequent work on our own and nature's part to repair what, in the light of later events, may prove to have been an injury. Experience alone can teach us just when to lay aside conservatism and take up the knife ; but it is this knowledge that is expected of the specialist, and while the general practitioner may be readily pardoned for making a premature and perhaps an unnecessary incision, the longer training of the specialist should enable him to calmly wait until the precise moment when waiting shall cease to be a virtue.

There are emergencies, however, in which, as I have said, the extremity of suffering is so great, the patient's self-control so wholly abolished, that the time required for cleansing and cocainization of the nasal passages, for the application of the adrenalin, and the reopening of the tube by Politzerization cannot be expended. The co-existence of such diseases as diphtheria or scarlatinous angina will also prohibit any procrastination. In such cases there is but one resort—the knife. Immediately upon the conclusion of an examination of the ear and the recognition of the necessity for operation, the canal should be first sterilized with a bichloride or formalin solution and then a few drops of the following solution should be instilled into the ear :
 R_y.—Cocaine hydrochlorat. gr. v-x, alcohol ʒj, ol. anilin ʒj.
 Some peculiar virtue seems to reside in this oil and alcohol com-

FIG. 110.



Line of incision. (BACON.)

bination that enables the cocaine to exert its anæsthetic effect upon the composite tissue of the membrane, so that during the five minutes that are consumed in making the few preparations for the operation it becomes quite insensitive and the use of a general anæsthetic will be uncalled for. The canal is now as brightly illuminated as possible and the membrane incised. This incision should be kept close to the posterior margin, and should extend from about the level of the stapes to the lowest portion of the drumhead. The minute puncture made by the paracentesis knife has very little drainage value, and its usually prompt closure necessitates one or several repetitions of the operation. The most satisfactory instrument for making the incision is a delicate curved bistoury. Should spontaneous rupture have already occurred, but the perforation be so small as to permit

only of very slow and incomplete drainage, it should be enlarged to the dimensions just advised. If the liberated pus is quite fluid and flows readily from the tympanum there will be no occasion to syringe or douche the ear with antiseptic cleansing solutions. A slender wick of some variety of antiseptic gauze may be carried to the bottom of the canal, and this will encourage the outflow of the pus. If, on the other hand, the purulent secretion contains much mucus, is thick, and needs some assistance to expedite its departure from the tympanum, syringing of the ear every few hours with a warm 1 to 3000 bichloride solution, or one of formalin, 1 to 5000, will prove of value. If, in conjunction with the free incision of the membrana, the active treatment of the nasal and postnasal passages that has been described shall lead to an early reopening of the Eustachian tube, the tympanum will become abundantly able to free itself of all offensive secretion and no inflation of the ear for the purpose of expelling the pus will be required. The natural recuperative powers of the mucous membrane will soon assert themselves, the suppuration will cease, the wound of the drumhead close, and the attack be but a memory. Appropriate systemic treatment should always be included in our management of this disease. The bowels should be kept soluble, the diet receive careful supervision, tonics given if needed, and any disturbing diathetic factor neutralized as far as possible. Such measures will greatly hasten the termination of the disease and render its chronic continuance an extremely remote possibility.

Upon the termination of an attack of acute purulent otitis and the cicatrization of the ruptured or incised membrana, gentle inflation of the middle ear by the Politzer bag or through the catheter should be practised daily for a week or more, in order that there may be no permanent interference with the normal mobility of the ossicles. Light pneumomassage of the membrane and ossicles may also be conjoined with the tympanic inflation.

CHAPTER XVIII.

CHRONIC CATARRHAL OTITIS MEDIA.

WITH our present knowledge of the pathology of catarrhal affections of the mucous membranes and of the tendency of this form of disease in one region to extend by continuity of tissue to others, it may be stated with little fear of contradiction that chronic catarrh of the middle ear is invariably secondary to a similar pathological process in the nose and nasopharynx. In view of the anatomical and physiological relations of the nose, throat, and ear a primary and independent chronic catarrh of the last-named cavity is inconceivable. The successive pathological phenomena that attend the invasion and development of the disease in the middle ear are closely similar to, if not identical with, those that mark its progress in the other two regions. The differences in the effects that they produce and in the symptoms to which they give rise are dependent upon the structural peculiarities of the tympanum and its relations to the internal ear, upon its exceedingly limited dimensions, and upon the functions that it subserves with reference to the sense of hearing.

The length and protective energy of the Eustachian tube may enable it to resist for a long time the advance of the catarrhal process to the middle ear, but the effect of frequently repeated and severe attacks of acute rhinitis and rhinopharyngitis will be to weaken this defensive power, and ultimately, perhaps, to overcome it. The coexistence of certain contributive factors of a systemic and diathetic nature, such as gout and rheumatism, will increase the vulnerability of the tubal and tympanic mucous membrane and do much to favor the establishment of the disease under consideration.

In the tympanum, as in the nose, it is in one of two principal forms that chronic catarrh manifests itself. The first of these corresponds to the hypertrophic variety of chronic rhinitis, the second to the atrophic or sclerotic form. With regard to the age, however, at which the two forms of disease are most apt to occur, the analogy existing between chronic catarrh of the nose and that of the middle ear seems to be defective. This defect consists in the fact that while it is in the young that we most frequently encounter atrophic rhinitis, it is in those of middle or advanced age that we find dry or sclerotic otitis. The same difference is observable with regard to the exudative or hyperplastic form of catarrh, it being the child who is most often affected by this type of otitis, and the adult in whom occurs the rhinitis of similar nature. The want of analogy in this respect, however, is probably more apparent than real, and it may be satisfactorily explained, perhaps, by the very great length of time required for an atrophic catarrhal process in the nose and throat to make its way to the ear. The type of inflammation involved in this form of catarrh is so sluggish, of such low grade, that years may pass and the child become an adult before it has finally crept through the tube and attacked the lining of the tympanum. It is quite true that many cases of sclerotic otitis are accompanied by no perceptible atrophic changes within the nose; but it is also quite possible, and I think probable, that all of these cases have been the subjects of purulent rhinitis during a portion of their childhood, and that, although in a certain proportion of them the tissue changes consecutive to this disease have been arrested in the nose and throat, they have nevertheless secured a foothold in the ear, and have insidiously advanced there in spite of their discontinuance at their site of origin. To the marked differences in the amount and arrangement of the vascular supply of the nose and the ear are, no doubt, to be largely attributed this difference in pathological outcome. The entire absence in the ear of anything resembling

the erectile mechanism of the turbinates must have some influence upon the relative nutrition and nutritive disturbances of the two regions. The seeming contrast that is also afforded by the moist or hyperplastic form of catarrh—this as a chronic otitis occurring in children, and as a rhinitis in adults—may be dependent upon a misconception of the real nature of the tympanic disturbance in the child. There is no sufficient reason for believing the several symptoms of this affection to be indicative of a genuine hyperplastic or hypertrophic alteration of the mucous membrane of the middle ear. They may all be explained upon the hypothesis that the disease is a perfectly simple chronic catarrhal process, accompanied, of course, by the usual vascular and secretory disturbances of chronic catarrhal inflammation, but wholly unattended by any demonstrable tissue change. In other words, it is identical pathologically with the simple chronic rhinitis that is not limited to any special period of life. The symptoms occasioned by this process in the middle ear are naturally accentuated by the very limited dimensions of this space and by the fact that the same amount of catarrhal swelling and exudation will give rise to a much greater proportionate amount of symptomatic disturbance than if it occurred in a more spacious cavity.

I doubt very strongly the influence of heredity as being directly causative of chronic catarrh of the middle ear. An acquired catarrhal deafness in the parent is never transmitted to the child. What the latter does inherit, however, is probably the same diathetic factor that has enfeebled the parent's mucous membranes, particularly those of the air and digestive tracts, and predisposed him to the occurrence of a secondary tympanic catarrh of chronic type. In much the larger number of cases the gastro-intestinal toxæmias—gout and rheumatism—are the diatheses in evidence.

Symptomatology. It is very fortunate that what is frequently one of the earliest symptoms of this disease—tinnitus—is sufficiently annoying, and perhaps alarming, among intelligent

people to induce them to promptly seek relief. It is equally unfortunate that such people are in the minority, and that in many instances the symptom is so mild at its commencement and so slow in its increase that those who are unobservant or dull of intellect are apt to regard it as of no importance, and to postpone any medical investigation in the ignorant hope that it will "get well of itself." It is at times abrupt in its beginning, as the result of some alcoholic or nicotine excess, or perhaps as the outcome of unusual fatigue or emotional strain. It may be intermittent or continuous, is, as a rule, aggravated toward evening, and is affected for the worse by damp or inclement weather. The character or quality of the noise varies within wide limits, and upon this feature of it will depend to a certain extent the degree of annoyance occasioned by it. Finally, it may precede or be simultaneous with or follow the appearance of deafness, and although in the matter of increase it usually keeps step with the deafness, it may, on the other hand, gradually diminish or even disappear as the latter symptom becomes profound.

In a very large proportion of these cases a great deal of uncertainty exists as to the exact or even approximate time at which the hearing has begun to fail. Such failure may have, and often has, begun long before the patient becomes conscious of his deafness, and, therefore, this symptom is of doubtful value as to the information it gives us concerning the duration of the disease. The impairment of hearing is directly due to the interference with the transmission of sound that is occasioned by the pathological alterations that affect the different portions of the middle-ear structure. The thickening and lessened elasticity of the *membrana tympani*, the ankylosis of the ossicular joints, the impaction of the foot-plate of the stapes in the *foramen ovale*, and, finally, the number and extent of the adhesions and *synechiæ* that firmly attach the drumhead to the inner wall of the *tympanum*—all these combine to reduce the functional activity of the ear. There are two or three peculiarities associated with the

deafness that merit special mention. It will often be found that although the patient may hear fairly well when conversing with a single person, yet when he attempts to take part in a general conversation, as at a dinner or reception, his ears fail to extract anything but disconnected words from the confused Babel of voices. Again, there are certain people with very defective hearing for sound in general who yet hear with a disturbing distinctness a few high-pitched or shrill tones. This little eccentricity is known as *hyperæsthesia acustica*.

Another peculiarity and seeming anomaly, the cause of which is still the subject of occasional speculation, is that the blunted hearing of some of these patients is considerably sharpened when they are in the midst of any loud and continuous noise. The rattle of a railway train or the clatter of a mill seem to awaken the dormant sense of hearing and to enable it to distinguish the ticking of a watch or an ordinary tone of voice while they continue. The term *Paracusis Willisiana* has been given this phenomenon. Its most plausible explanation is probably that of Politzer, who says that "the improvement in hearing is due to the movement of the inflexible auditory ossicula, so that they are placed in a more favorable condition for the conduction of the waves of sound, and that, at the same time, the terminations of the auditory nerve are set in vibration, producing an increased sensibility." The symptom is regarded as of unfavorable significance and is supposed to accompany the more advanced degrees of thickening or sclerosis of the tympanic mucosa.

Pain is, as a rule, neither a frequent nor prominent symptom of this disease. There may be occasional sharp twinges, but they are of scarcely more than momentary duration and rarely provoke complaint. It is rather of the sense of fulness or stoppage of the ear that the patient is apt to complain, and it is particularly in the early stages of the disease, when this symptom is intermittent and before the patient is accustomed and more or less resigned to it, that it is most annoying.

An occasional symptom of generally late appearance in the course of the disease is vertigo. When the sinking and impaction of the stapes in the oval window has become pronounced and unyielding as a result of the contraction of the tensor tympani muscle, the retraction of the membrana and the rigidity of the ossicular chain, the consequent compression of the intralabyrinthine fluid may cause severe disturbance of the motor filaments of the auditory nerve and of the cerebellar peduncles, and be announced by vertiginous attacks of varying frequency.

Alterations in Appearance and Position of the Membrana Tympani. Usually that feature of the membrane which is earliest lost is its lustre. This soft, opalescent sheen is replaced by dulness, and, in most cases, opacity. This latter change may occur in isolated patches occupying different portions of the membrane, or the whole drumhead may be affected by it. In association with it there is commonly a greater or less amount of thickening. This also may occur in limited areas with spaces of approximately normal membrane between them. Not seldom, however, instead of the thickening and opacity, the membrane undergoes an atrophic thinning and becomes even more transparent than normal, so that not only may the incudo-stapedial articulation be distinctly seen, but the membrane acquires a diffused pinkish tint from the background formed by the congested inner wall of the tympanum.

In addition to these changes we will quite frequently find deposits of chalky or calcareous material in the tissues of the membrane. These are of varying extent and conformation and occupy most often, perhaps, that portion of the membrana lying in front of the manubrium.

The most characteristic alteration of the drumhead, and that which is most significant of the existence of the intratympanic catarrh, is the change in its position. As consequences of the handle of the malleus being drawn upward and forward and being simultaneously rotated upon its long axis, the membrana is

not only retracted as a whole, but its anterior half is noticeably more deeply indrawn than the posterior. The change in its position leads, also, to an apparent shortening of the manubrium, the short process of the malleus becomes overprominent, and the anterior and posterior folds of the membrana acquire added distinctness. Finally, the cone of light is shortened or perhaps almost extinguished by the obliteration of the normal curvature of the drumhead.

Pathology. The pathological events that mark the course of chronic catarrhal inflammation of the tympanic mucous membrane are identical with those that are occasioned by analogous types of inflammation of the pituitary mucosa. These latter, having been already described, may be applied without modification to the middle ear. The effects produced by the inflammatory tissue changes, however, vary quite widely in the two cavities because of their different anatomical features and physiological functions. One unfortunate result, for instance, of the proximity of the outer and inner walls of the tympanum is the development of the synechiæ and even direct adhesions that often unite their opposing surfaces. The structure of the Eustachian tube, also, is such that it requires but a comparatively slight amount of catarrhal swelling to stint or entirely deprive the middle ear of its normal supply of air.

Diagnosis. The history given by the patient, the presence of the characteristic subjective symptoms of the disease, the co-existence of nasal and nasopharyngeal catarrh, and the information derived from inspection of the drumhead should be quite sufficient to render the diagnosis of chronic catarrhal median otitis an easy matter. In addition, however, it will be incumbent upon the surgeon to discover or exclude the existence of labyrinthine involvement by the application of Rinne's and Weber's tests.

Prognosis. The influence of a number of factors must be duly weighed and averaged as an essential preliminary to the formation of an intelligent prognosis. The duration of the disease,

the stage of its pathological progress, the degree of immobility of the drumhead, the general health of the patient, his occupation, his domestic and climatic environment, and, finally, his age, must all be considered. As a general rule, the prognosis will be unfavorable in those cases in which tinnitus has for some time been loud and unintermittent; in which deafness has been of early occurrence and rapid in its increase; in which, with a permeable tube, inflation of the tympanum effects no noticeable improvement in these two symptoms; and in which, finally, the nasal and postnasal catarrh is dependent upon constitutional rather than upon easily removable local causes. In those cases, on the other hand, in which the reverse of these conditions obtains, and in which, moreover, there is no demonstrable involvement of the labyrinth, the prognosis will assume a much brighter expression. In either event consideration for the patient's feelings should not be lacking; and while, in the one case, it would be brutal and perhaps distinctly injurious to abruptly annihilate his hopes, caution should be observed in the other, lest they soar to an unjustifiable height.

Treatment. In the very large majority of chronic catarrhs of the middle ear nothing will so hasten the arrest of the disease and the consecutive removal of the effects that it has occasioned as the postponement for a time of any active treatment of the tympanum itself while we devote all our energies to the removal of the causes that have led to its disturbance. So long as these are permitted to continue effective, many of the measures commonly employed for their supposedly direct beneficial influence upon the tympanic mucous membrane will not only prove utterly useless, but instead of restraining, they may, indeed, aggravate the catarrhal condition. The importance of the fact and the necessity for bearing it constantly in mind justify the iteration and reiteration of the secondary nature of this middle-ear disease. If we fully appreciate the pathological significance of this fact, its therapeutical significance cannot fail to appeal to us with due force.

With the possible exception of a very limited number of cases of insidious sclerotic otitis, which, it is asserted, are of primary tympanic origin and are unassociated with catarrh of the communicating air passages, the other cases are all consecutive to disease of a similar type of the nose and nasopharynx. There would seem, therefore, to be no excuse for harping upon the supreme importance of restoring the nasal and postnasal cavities to a state of health with all possible expedition. And yet, in spite of the seeming patency of this to any logical mind, we are told by a few overcautious otologists that the treatment of the nose and throat should be exceedingly mild, and, from the almost impotent remedial measures that they advise, we cannot but infer that they think it quite subordinate to that of the ear. A judicious conservatism with reference to nasal surgical procedures is to be warmly applauded; but though certain trivial deformities of or projections from the septum may have no obstructive significance, yet they may be partially responsible for the causation and maintenance of a chronic nasal catarrh; and until this shall be overcome the most wisely selected and skilfully applied treatment of the ear itself will procure us no more than incomplete and transient relief.

While, however, there is to be no slighting of local measures for the subjugation of any chronic nose and throat disturbance, we are to be equally energetic in combating any systemic condition that may encourage its continuance. I might, perhaps, at once dismiss this subject by referring the reader to the chapters on acute and chronic catarrhal rhinitis; but I cannot neglect this opportunity to emphasize here, with reference to the ear, the importance of the same close study of the patient's general health that I have there advised with reference to the nose. Scarcely a day passes that I am not the more firmly strengthened in my opinion that by far the greater number of local ills to which the body is subject are to be traced to causes of a systemic nature. I have referred, with no doubt tiresome insistence and repetition,

to the basic rôle that is played by the many functional disturbances of the gastro-intestinal tract. One of these will inevitably lead to others, and in the course of time we will find that the blood-current contains more poison than pabulum, more irritating toxins than nutritive elements. The general nutritive impoverishment that ensues upon such fouling of the blood is evidenced in no way more quickly and clearly than by enfeeblement of the vasomotor centres and a consequent reduction of their inhibitive powers. Local congestions and inflammations under slight provocation are a direct and frequent outcome of this loss of control over arterial tone, and it needs but a few repetitions and incomplete resolutions of these acute reactions for the establishment of those chronic catarrhal processes that affect the upper air passages with such unfortunate frequency. To merely assail the gouty and rheumatic diatheses so often associated with these catarrhs, with the customary routine resort to alkalies, salicylates, and colchicum, is to strike at the branch instead of the root of the disorder ; to be content with a compromise rather than a radical reform. If we would be strictly rational, therefore, it is at the very beginnings of pathogenesis that we must direct our corrective measures. Every article of food or drink that overtaxes the enervated digestive process must be at once banished from the diet. A period of functional rest will greatly hasten functional recuperation, and, therefore, the customary quantity of food—usually far in excess of the demand—should be divided by two or three. Immediately, also, we must encourage the elimination not only of the toxic materials that encumber the blood, but of those, also, that are lurking in the tissues and that have been accumulating there for years. The natural saline aperient waters are probably the best stimulants of intestinal peristalsis, because they are, at the same time, active diuretics. These will gradually cleanse both the bowels and the blood ; but if we are to expel from the tissues the accumulated waste and corruption of years it is only through exercise—persevering, systematic, and energetic—that we can

accomplish it. In all probability this will have to be gentle at first, but it should be rapidly increased as the patient's gain in vigor will permit it. Occasional general massage will be an efficient assistant in promoting this tissue disinfection, and if this be used in connection with the Turkish bath its good effects will be enhanced. Cold baths should be absolutely interdicted until the patient's improved condition will make his reaction from their temporary depressing effect prompt and complete. Even then a general cold sponge while standing in three or four inches of warm water will be less hazardous than the cold plunge or shower. A final and very important addition to this list of hygienic requirements will be the drinking, particularly between meals, of a very large amount of water. It may be cool, but not iced, and, unless the patient already has the water-drinking habit, it will probably be necessary to repeatedly remind him, or more especially her, of its importance. While it is imperative that these several instructions shall be adopted and conscientiously adhered to by the patient, it should also be required of him that he completely abandon the use of tobacco, alcohol, coffee, tea, and cocoa. The four beverages are almost equally objectionable. The caffeine of coffee, the thein of tea, and the theobromin of cocoa are all synthetically active in the production of uric acid, and should all be prohibited. Acid drinks, also, are unfit because of their subalkalizing effect upon the blood and the consequent reduction of its solvent power.

This group of suggestions, then, will constitute the essentials of the hygienic reform that is to be accomplished, and unless they be rigidly observed by the patient the efforts of the physician to arrest the catarrhal process will be seriously hampered.

At the end of a few days, during which the patient will have been using an alkaline nasal spray and have had his intestines well emptied and more or less disinfected, we are to commence the direct treatment of the middle ear. This will be intended to compass several results. In the first place, we must hasten to

restore and afterward to maintain the patency of the Eustachian tube. Every detail in the treatment of the nose and throat that will contribute to this end is to be carried out with sedulous care. It is taken for granted that any nasal condition, be it septic, hypertrophic, or neoplastic, that occasions any material amount of obstruction or excites any catarrhal reaction is to be promptly removed. The nasopharynx will be relieved of any adenoid growth that may be present, and in case one or both of the faucial tonsils are enlarged or are the seat of lacunar catarrh, these also had better be got rid of. If none of these operations is necessary, or should it be, as soon after its performance as cicatrization will permit, inflation of the middle ear should be practised. With the beneficial effects of this procedure we are already familiar, and our selection of the Politzer bag or the catheter will be influenced to a certain extent by the age and temperament of the patient. Other things being equal, the catheter is always to be preferred. The precautions to be observed in its use have been recounted, and I need only repeat that particular gentleness of inflation is necessary in those cases of sclerotic catarrh that are accompanied by any atrophic thinning of the membrana tympani. Anything in excess of the actual amount of force needed in these cases is apt to result in rupture of the dry and brittle membrane. In the other variety of middle-ear catarrh, however, catheter inflation may be employed not only with safety, but often, in proportion to the length of standing of the disease, with very decided benefit. In many cases the remedial effects of this procedure may be greatly increased by medicating the air that we propel into the tympanum by the addition of certain vapors. For this purpose five or six drops of the iodide of ethyl may be introduced into the air bag, or the same amount of a combination of tinct. iodin., gtt. xv; chloroform, spt. vini rectific., āā ʒss. In place of these we are enabled by the addition of a nebulizer to our apparatus to take advantage of certain of the essential oils—cassia, eucalyptus, gaultheria—and

with these in a vehicle of some bland oil, such as benzoinol or albolene, menthol may be combined in a proper proportion. It is probably much better to introduce them in a finely nebulized form into the middle ear than to inject them in bulk through the catheter.

In conjunction with inflation and medication of the middle ear a very valuable additional means of a purely mechanical nature is what is known as pneumomassage of the membrana and ossicles. This is designed to restore to the drumhead its normal position and mobility by overcoming the contraction of the tensor tympani muscle, by stretching or rupturing any recently formed adhesions, and by gently exercising the stiffened ossicular joints. This form of massage will also stimulate the sluggish circulation within the tympanum and favor the removal of inflammatory products by absorption. It may be applied by means of the Siegle otoscope, the air in the auditory canal being exhausted either by the suction power of the operator's lungs or by the "masseur" or "rarefacteur" of Delstanche, which can be attached to the tube of the otoscope. In place of these we may use a masseur engine run by compressed air, by water-power, or by belt from an electric motor. This apparatus enables us to exhaust the air in the meatus at regular intervals, the frequency of which may be controlled by the operator. As a rule, two or three strokes of the piston to the second will be sufficiently often; very little power should be used, and throughout the procedure, which should last not more than twenty or thirty seconds, the membrana should be kept under close observation. The cases in which it is employed should be carefully selected, for in those in which there is atrophic thinning and relaxation of the membrane harm rather than good may be produced.

The probe with cup-shaped extremity devised by Lucae for the purpose of imparting movement to the ossicular chain, requires something more than ordinary skill for its safe employment. It is placed upon the short process of the malleus, and light and

rapidly intermitted pressure made, which will give to the bonelets some much-needed exercise. Except in the gentlest hands, however, this measure is not unattended by risk ; and although it may for a time be productive of some slight improvement of hearing and diminution of tinnitus, yet this is apt to be rather short-lived.

It will be appropriate to here recall attention for a brief space to the Eustachian tube and to some of the permanent results of catarrhal inflammation that may at times be found in it. There is a by no means small number of cases of chronic catarrhal otitis media in which satisfactory inflation of the tympanum cannot be accomplished. Attempted inflation by means of the catheter and air bag, the auscultation tube at the moment connecting the surgeon's ear with that of the patient, will be attended either by no sound whatever, or else by one of a thin, squeezed, whistling character that is unequivocal evidence of tubal obstruction.

In the earlier stages of the catarrhal process narrowing of the tube may be dependent upon nothing more than vascular engorgement of its lining membrane and the presence of an excess of viscid mucus. This is usually readily overcome by the reduction of the nasopharyngeal catarrh and a few repetitions of simple air inflation by the catheter. At a somewhat later period, when vascular leakage has added to the obstruction by occasioning a certain amount of infiltration of the submucous tissue, this also will, as a rule, gradually disappear through the stimulation of the absorptive processes that may be effected by inflation with the vapors of iodine, iodide of ethyl, or the different balsams. At a still more advanced period of the pathological process, however, when fibrous organization of the cellular hyperplasia has been succeeded by the sclerotic changes which mark the impairment of nutrition, we not infrequently find the lumen of the tube almost obliterated at one or more points by strictures so firm and resistant that they prove impermeable to the air douche of even exceptional vigor.

It is in this last group of cases that treatment with the Eustachian bougie has been very often attended by gratifying results. The instrument may be constructed of whalebone, of silkworm-gut coated with lacquer, or of metal. It should be of such length that it may be projected at least an inch and a half beyond the tip of the catheter, and the circumference of its oval head is to correspond to Nos. 2, 3, or 4 of the French scale. It is introduced through a silver catheter of appropriate size. Its extremity is dipped in some sterile lubricant, and it is then passed slowly and very gently into the tube. When the stricture is encountered no incautious amount of force is to be employed to effect its penetration, but the operator is to patiently maintain a very moderate pressure until the stricture gradually yields and permits the bougie to pass on into the tympanum. It should usually be allowed to remain in the tube for from five to ten minutes. Two or three repetitions of this operation at intervals of four or five days will in many cases result in very considerable diminution of the deafness and tinnitus.

A final method of restoring the patency of the constricted Eustachian tube is by the employment of electrolysis. In spite of the fact that this measure is slow in gaining general appreciation and adoption, and that its use is as yet restricted to a comparatively small number of operators, there should certainly be no difference of opinion as to its very great value. The results obtained in a large number of cases by Duel, who really deserves the credit for attracting attention to the operation and for perfecting the instruments and the technical details involved in it, have been so gratifying that they should quicken confidence in it and gain for it, at least, a wide-spread trial. He recommends that the bougie shall be of gold, and that, when its oval head has reached the opening in the tip of the catheter, the negative pole of a thirty to fifty-volt battery should be connected with it one and a half inches from the opening in the catheter handle. The catheter is to be thoroughly sterilized, and then insulated by

wrapping it from tip to ring with a narrow strip of thin rubber tissue. After a careful preliminary cleansing of the nose and nasopharynx and cocainization of the lower nasal meatus the catheter is introduced and its tip snugly lodged in the pharyngeal orifice of the tube. The patient's connection with the positive pole of the battery is secured by his holding in his hand an ordinary contact electrode. The bougie is now gently propelled through the tubal canal until it encounters the obstructing stricture. Instead of forcing it past this by increase of pressure it is held in steady contact with it and a current of from 1 to 3 milliamperes turned on. In most cases a twenty to sixty seconds' application of this current strength will so soften and relax the stricture that the bougie will easily glide past it. Should, however, the resistance prove obstinate, it will be better to increase the current strength, even up to 5 or more milliamperes, rather than to assume the risk that attends an increase of pressure. As a rule, five minutes should be the limit of the *séance*, and it may be repeated at intervals of one or several weeks, depending upon the degree of gain in the patency of the tube. This may be gauged by the results of inflation applied every second or third day. Ordinarily, two to four repetitions of the operation have proved sufficient to re-establish the normal lumen of the tube. It is scarcely necessary to add that the battery should be provided with a reliable rheostat and milliamperè-meter.

Several advantages are possessed by electrolysis over the mere mechanical stretching of the tubal stricture that has hitherto been the one measure commonly employed. In the first place, its much greater rapidity is a strong point in its favor. Instead of the indefinite and usually prolonged period of treatment required by the ordinary system of bougieing, a very few applications of the electrolytic current—possibly not more than one or two—have in several instances proved sufficient to restore the normal calibre of the canal. Moreover, this method will succeed in certain cases in which the stricture is of such density and narrowness as

to prove impenetrable to the bougie alone without a dangerous exhibition of force. The facts that electrolytic action removes the obstruction by effecting its disintegration and absorption, and that this can be obtained by scarcely more than mere contact with the energized bougie, frees this method of the traumatic dangers that environ simple mechanical dilatation. Again, it has been demonstrated that when a stricture has been once thoroughly reduced by electrolysis there is little or no liability of its return. The permanency of its results, therefore, places it in strong and favorable contrast to the too often merely temporary ones gained by the other method. Of course, if the primary pathological process is permitted to continue it is not unlikely that new strictures may form, but there will be no recurrence of the one that has been destroyed. It may be pointed out, in conclusion, that the measure of success attending this procedure with reference to the relief of deafness, tinnitus, and vertigo will be directly proportionate to the amount of pathological change that has already occurred within the middle ear. Where this is comparatively slight, and the effect of tympanic inflation is a material, though brief, diminution of the just-mentioned symptoms, the curative influence of a re-established patency of the tube will not only be powerful in itself, but it will so facilitate the application of remedies to the middle ear that the prognosis will become much more bright.

SURGICAL TREATMENT. With but few exceptions, those who may be regarded as authorities in the field of otology unite in disparaging the utility of the several operations that have been proposed for the relief of the more afflicting symptoms of chronic catarrhal median otitis. It is my own confident belief that in case of the failure of the general and local treatment already detailed to exert a modifying influence upon the deafness, tinnitus, and occasional vertigo that characterize this disease, a resort to surgical measures will prove equally futile. These three symptoms usually arise during successive stages of the catarrhal

process; and their appearance, consecutive to one another, is usually denotive of different degrees of retraction of the drum-head, immobility of the ossicular chain, and fixation of the stapes. It is for the radical removal of these pathological results of the catarrh and the consequent relief of the symptomatic disturbance that they occasion that the aid of surgery has been invoked. It may be said at the outset that it is only in those cases in which the bone conduction of sound is unimpaired—in which, in other words, there is no evidence of disease within the labyrinth—that treatment of this character is permissible. Even in carefully selected cases, however—those which have seemed the most likely to yield favorable results to surgical measures—the disappointments have been so numerous, the successes so few, that little encouragement has been afforded the advocates of this plan of treatment. In any event, the study of statistics certainly seems to indicate that it should be not only a last resort, but that it should be applied to those cases only that are already so bad that they can scarcely be made worse. It is a vain hope, even, that any operation may arrest the catarrhal process when other and more rational treatment directed to that end has proved ineffective.

The various operations that have been proposed and been more or less popular for brief periods during the past half century, include the making and maintaining of an artificial opening in the membrana tympani, the section of the posterior fold of the drumhead, division of the tensor tympani muscle, the removal of the membrana with the malleus and incus, the extraction of the incus alone, and, finally, the removal of the stapes.

All of these have for their common objects the freer transmission of the sound waves to the inner wall of the tympanum, their more immediate contact with the oval and round windows that connect it with the labyrinth, and, in addition, the removal of abnormal pressure upon the labyrinthine fluid; but while they may all be perfectly logical and rational in their conception, their

application has seldom realized the hopes that their design seemed to justify. The making of an artificial opening in the membrana by excising a portion of it may, in those cases in which fixation of the foot-plate of the stapes has not yet occurred, improve for a time the hearing and lessen the tinnitus. It is no easy matter, however, to prevent closure of the opening; and in spite of the galvanocautery or chromic or sulphuric acids—the use of which, by the way, involves a certain amount of risk—nature usually persists in healing the wound. Moreover, this crude little operation is apt to aggravate rather than restrain the catarrh of the middle ear, and to hasten thereby the ultimate immobilization of the stapes.

FIG. 111.



Politzer's incision through posterior fold of drumhead.
Handle of malleus foreshortened; anterior and posterior folds of the drumhead
very prominent. (BACON.)

When, in conjunction with marked retraction of the drumhead and handle of the malleus and a consequent increased prominence of the posterior fold of the membrane, there is pronounced deafness and loud tinnitus, Politzer has suggested that the tension and pressure be somewhat relieved by an oblique incision through the posterior fold of the drumhead. This is best made a short distance behind the *processus brevis*. The relief afforded, however, is not only insignificant, but transient.

Another minor operation which, at first glance, is apt to appeal to the fancy, is tenotomy of the tensor tympani muscle. The fibrous sheath which envelops the tendon of this muscle makes it particularly susceptible to the inflammatory alterations and sub-

sequent contractions that mark the course of middle-ear catarrh. The shortening of the tendon occasioned by such cause results in continuous traction upon the handle of the malleus and the drum-head, and leads to increase of pressure, through the other bones, upon the fenestra ovalis. If the contraction of this tendon were solely responsible for all the ensuing symptoms its early division would be a measure of urgent importance. Unfortunately, however, it only precedes by a little while the occurrence of the same pathological changes in the other structural features of the tympanum; and the operation, therefore, while it may delay for a time the increase of symptoms, can do no more than this. Its performance involves an incision through the membrana, usually posterior to the handle of the malleus, and through this a delicate tenotome curved upon the flat is introduced. The blade is carried beneath the tendon, and, its point being then raised, the tendon will be divided as it is withdrawn. The rarity with which the operation is now performed is due to the unsatisfactory results obtained by it.

The more extensive and radical operations that are occasionally resorted to for the relief of distracting tinnitus, severe and frequently repeated vertiginous attacks, or extreme degrees of deafness, include removal of the membrana tympani with the malleus and incus, or extraction of the incus or the stapes alone. The purpose of the first two of these is to relieve the stapes of the pressure that drives its foot-plate deeply into the oval window and so provokes intralabyrinthine disturbance. It is scarcely conceivable, however, that the pathological process responsible for this pressure could have affected the drumhead and the two larger bonelets for any length of time and left the stapes unscathed. In other words, in all such cases we may be reasonably certain that fixation of the stapes has already occurred. Its impaction has been rendered permanent by fibroid changes in the tissue that surrounds the oval window and connects it therewith. Of what immediate or remote benefit, therefore, will be any operation

which does not include the removal or at least the renewed mobilization of this bone? Instead of wasting time, therefore, by removing merely the drumhead and one or both of the other ossicles it will be infinitely better and more rational to perform at once a stapedectomy. Reason and experience both justify Blake's assertion that "the stapes holds the key to the situation," and if *any* operation be deemed necessary it is this that should be selected. I give, largely in his own words, the method of procedure employed by Blake: "The ear to be operated upon should be first carefully tested as to its hearing power, both by aërial and bone conduction, and with due reference to the possibility of sound transmission, either by aërial or bone conduction, to the other ear. The external auditory canal should be cleansed of cerumen and loose skin, and then washed with a weak bichloride solution on a cotton-tipped probe and stopped with antiseptic cotton until the time of the operation." The necessary instruments include a paracentesis needle, a delicate angular knife for dividing the articulation of the incus and stapes, a blunt hook, and a pair of slender but strong angular forceps. In addition to these, the surgeon may have at hand a small, rectangular knife for dividing any remaining attachments between the incus and stapes after their joint has been severed, and a pair of delicate forceps with straight blades for the removal of any loose fragments of bone should the stapes be fractured during its extraction.

The usual accessories of such an operation—such as cotton applicators, vessels for antiseptic solutions, a 4 per cent. solution of cocaine, and a 1 to 2000 of adrenalin—should also be provided. Every essential precaution for antiseptics should be scrupulously observed. The difficulties of the operation will be greatly lessened if it be performed under local rather than general anæsthesia, and the former may be obtained by injecting into the middle ear through the Eustachian catheter four or five drops of the cocaine solution some few minutes previous to the

incision of the membrane. A high-backed chair will give support to the patient's head, and it should be additionally steadied by the hands of an assistant. The tympanum is now opened by an incision which, "beginning at a point midway between the short process and the tip of the long process of the malleus, and close to the manubrium, extends upward along the posterior ligament of the short process and follows the periphery to a point posteriorly on a line with the tip of the manubrium." The flap thus made falls outward and downward, leaving an opening which affords us an unobstructed view of and free access to the proposed field of operation. A reapplication of the cocaine solution may now be made for the double purpose of controlling pain

FIG. 112.



Triangular incision in the postero-superior quadrant for exposing the articulation of the incus and stapes. (POLITZER.)

and preventing hemorrhage; but should troublesome bleeding occur in spite of it the adrenalin solution will promptly arrest it. After a renewed test of the hearing at this stage the operation is resumed by dividing the tendon of the stapedius muscle with the curved or small angular knife. To assure himself of its complete division the surgeon may now select a larger angular knife and pass it behind the incus. Before any traction is made upon the stapes to effect its removal its foot-plate should be loosened as much as possible from its attachments. This having been done, a blunt hook with a slight backward curve is passed into the apex of the space enclosed by the crura, and traction made, very gentle at first, and then slowly increased until the bonelet is

detached. Any hemorrhage may again be checked by the adrenalin solution, and the meatus is then to be closed by a pledget of sterilized cotton or gauze and the patient put to bed for a day or two. The results obtained by this operation have been so unsatisfactory that if performed it should be at the request of the patient rather than by the advice of the surgeon.

CHAPTER XIX.

CHRONIC PURULENT OTITIS MEDIA.

THE importance of this disease is derived not only from its frequency and the disturbing character of the symptoms that usually accompany it, but, far more, from the very serious and often fatal complications to which its neglect or improper treatment may give rise. It is from among the poorer and less intelligent classes that the greater number of cases is drawn; and this is probably largely due to the prevalence of a traditional belief that the arrest of a chronic discharge from the ear—the cure of a “running ear,” as they call it—is harmful, and that the proper and safe course to pursue with reference to it is one of non-interference. Incredible as it should seem, humiliating as it is, there is still a small but happily fast dwindling proportion of general practitioners who discountenance what, in their ignorance, they are pleased to term “meddling” with this disease, and who counsel the sufferer from it to “let it take care of itself,” or, if it be a child, who assure the parents that the little victim will “outgrow” it.

While there is a small number of cases of tuberculous origin that are of chronic type from their very commencement, all the others may be referred to a primary acute suppurative inflammation of the middle ear. The establishment of the chronic process in the latter class of cases, besides being due in many instances to neglect or ill-advised treatment of the acute stage, may also at times be attributed to the influence of certain constitutional dyscrasias, those most frequently present being syphilis, tuberculosis, the auto-intoxications following diabetes, or those that are etiologically related to gout and rheumatism. Of even greater

causative effect than these, however, is the influence of nasal and nasopharyngeal disease, which, if either untreated or treated in a merely perfunctory manner, will do much to make chronic a disease whose acute stage would otherwise have ended in complete cure. The virulence of the acute middle-ear inflammation that so often accompanies scarlet fever, measles, diphtheria, and influenza frequently occasions of itself such deep and extensive disease of the tympanum and its accessory spaces that the pyogenic process and the processes of repair are apt to be prolonged far beyond the ordinary limits of an acute stage.

It will economize space and quicken comprehension of the conditions with which we have to deal in these cases if we divide them into two or three groups, according to their relative duration of chronicity and to the different degrees of pathological change that characterize each. In the first of them we may encounter scarcely more than hyperæmia of the tympanic mucous membrane, more or less thickening due to persistent round-cell infiltration, and, finally, the presence of the purulent secretion. In a second we will discover more advanced and serious alterations. The continuance of the cellular infiltration has led to hyperplasia and perhaps hypertrophy of the mucosa, and, quite often, to its polypoid degeneration accompanied by the development of granulations. The mucoperiosteum shares in these alterations, and, as a consequence of the inevitable interference with the nutrition of the ossicles and of the bony walls of the tympanum, we are apt to have limited or extensive areas of caries or necrosis. A third and last group includes those cases in which there has been extension of the disease to the antrum and to the cellular structure of the mastoid process. It is in these that we not infrequently find, particularly in the antrum and mastoid cells, the epithelial masses known as cholesteatomata.

Symptoms. In all cases of this disease there is more or less impairment of hearing. This varies within wide limits, since it amounts in some instances to no more than slight dulness of

audition, while in others, particularly those in which there is implication of the labyrinth, it may extend to complete deafness. Excluding those cases in which the loss of function is due to consecutive labyrinthine disease, the variation of this symptom depends less upon the size of the perforation than upon the extent of retraction of the remnant of the membrana and the degree of impaction and fixation of the foot-plate of the stapes in the oval window. Deafness is apt to be especially marked in those cases that have been occasioned by attacks of diphtheria, scarlatina, or typhoid fever, and syphilis, also, may at times be responsible for serious loss of hearing. The somewhat surprising increase of deafness that now and then ensues upon arrest of the discharge, may probably be explained upon the hypothesis that one effect of the drying of the ear is to induce contraction of the newly formed tissue elements in the mucosa, and this supposition is rendered the more plausible by the fact that an equally surprising and proportionate improvement of hearing usually attends a reappearance of the discharge and a renewed relaxation of the tissues under its moistening effect.

Whether or not the disease has affected the integrity of the labyrinth to any extent may be ascertained through an investigation of the bone conduction of sound by the tests of Weber and Rinne.

Tinnitus is an occasional symptom of this disease, but not nearly so frequent or annoying as in the non-suppurative type of catarrh.

The character and quantity of the discharge will be found to vary with the duration of the disease. The more recent the disease the more abundant, as a rule, will be the purulent flow. As a general rule, other conditions being about the same, the discharge is apt to be more profuse in children than in adults. The nature of the secretion being influenced to a great extent by the pathological alterations present in the middle ear, we will usually find it in the earlier stages of chronic suppuration a

creamy, laudable pus. If, in association with the tympanic disease, there is an active catarrh of the nose and nasopharynx, the middle-ear discharge will be thickened and rendered rather ropy in character because of its admixture with a quantity of mucus. If not a constant feature of the discharge in any given case, this mucoid element is yet liable to appear at any time in conjunction with an intercurrent coryza or acute inflammatory disturbance of the postnasal space and the Eustachian tube. Its effect is to increase the viscosity of the secretion, and by doing this to interfere with both the freedom of its escape from the tympanum and the ease with which it may be removed. In order to cleanse the meatus of such a discharge we are not infrequently compelled to resort to the assistance of the syringe or the forceps. In other cases, in which the vascular disturbance is of rather a sluggish character and in which there is but a moderate amount of epithelial desquamation, the discharge is scanty, pale, and of a thin, liquid consistence. At later stages of the disease, however, when granulations and perhaps polypi have made their appearance, when the mucoperiosteum has been destroyed at one or several points, and the denuded bone, for lack of nutrition, has become carious or necrotic, these events will be announced by the appearance in the discharge of more or less blood, and, in case of caries of the ossicles or of the bony wall of the tympanum, by the addition to it of fetor. If, in spite of regular and thorough cleansing, this fetor persists, and if, especially, the color of the discharge be of a brownish cast and its quantity be considerable, the chances are strongly in favor of there being involvement of the antrum and the mastoid cells.

The perforation of the membrana tympani may, in some few cases, be so extremely small that its discovery may become a matter of considerable difficulty. If the curvature of the auditory canal be greater than usual, and the perforation is small and situated near the anterior margin of the membrane, it will at times be impossible to bring it into view. In the absence of evident

disease of the canal or of the membrane itself, the presence in the canal of a constantly renewed purulent secretion will establish, of course, a moral certainty as to the existence of a suppurative otitis and a perforation of the membrane. To make this certainty absolute, however, we have but to thoroughly cleanse the external ear and then to introduce the speculum and closely observe the drumhead while the patient inflates the tympanum by the Valsalvan method. A drop or two of pus will be forced through the perforation by this procedure, and its existence and site at once determined. Should it be so situated that it cannot be seen, inflation by Politzerization or by means of the catheter in conjunction with the use of the diagnostic tube will greet the ear of the surgeon with the whistling sound that is pathognomonic of rupture. Between the pin-point perforation and complete destruction of the membrana there may be every degree of size and several varieties in the shape of the breach. In form it may be round, oval, kidney-shaped, or perhaps entirely irregular in its outlines because of partially successful attempts at cicatrization.

Previous to the inspection of the drumhead the meatus will, as a matter of course, be emptied of all the secretion, liquid or dry, that it may contain. If the discharge has been scanty, and scales or crusts have been formed deep within the canal and are closely adherent to its walls, it will be better to soften them with the syringe and a warm antiseptic solution before attempting their forcible removal with the cotton applicator or the curette. Upon the completion of the cleansing and the subsequent introduction of the speculum we may discover not one only but perhaps two or three openings in the membrana. This is unusual, however, and one is the ordinary limit. In the majority of cases the situation of the perforation is in the anterior inferior quadrant of the membrane, the next most frequent region for its occurrence being the corresponding posterior quadrant. If it be of considerable extent, and should it encroach upon the central portion of the

membrane, the handle of the malleus will usually project some distance into it. This process may still be intact, or, on the other hand, we may find it denuded and carious. Upon the size and situation of the opening will depend our ability to inspect the tympanic cavity and its contents. The inner wall is in most cases of a deep red color. Should the perforation involve a large portion of the upper and posterior half of the membrane we are not infrequently enabled to see the long process of the incus, the incudo-stapedial joint, and perhaps even the rami of the stapes. The depression which marks the location of the fenestra rotunda may also at times be seen with some indistinctness. Should, however, the infiltration and swelling of the tympanic mucous membrane be of some degree our view of these structural details may be greatly obscured. In long-standing cases in which nature has made some attempts at repair we may find that the margins of the perforation have become attached to the inner wall of the tympanum. In the latter stages of the disease, when sclerotic change in the hyperplastic tissue is well advanced and its vascular supply is greatly diminished by the progressive contraction that marks such alteration, the mucous membrane of the inner tympanic wall loses its red color and becomes almost dermoid in its appearance and texture.

There is a certain class of cases of chronic suppurative otitis that is almost deserving of separate description and study. It includes those cases in which the disease is seemingly limited to the "attic" or epitympanic space. In these the perforation will be found not in the membrana tensa, but in some portion of the membrana flaccida or Shrapnell's membrane. It is most often extremely small, and may require careful scrutiny for its discovery. The purulent discharge is ordinarily but slight in amount, and instead of accumulating in any noticeable quantity in the meatus it may be restricted to the upper portion of the drumhead and the adjacent where it is apt to
undergo inspissation and be softened

and afterward removed by the cotton mop or the curette, and the membrana flaccida is then carefully cleansed of the film of pus that usually covers it, the perforation will be exposed and perhaps readily detected. A minute polyp occasionally projects through it and plainly marks its location, or at times a little drop of pus, looking like a seed-pearl, will slowly make its exit and appear upon the surface of the membrane. Although in these cases there may be no discernible involvement of the tympanic cavity proper, yet it is highly probable that the attic disease is simply the lingering remnant of what was once a general median otitis. If the anatomical features of the upper portion of the tympanum are recalled we will recognize the ease with which this so-called attic may be shut off from the larger portion of the chamber by inflammatory disturbance, and with which a suppurative process that perhaps spontaneously subsides in the lower cavity, may persist and be indefinitely prolonged in the upper one. The latter, appropriately termed the *recessus epitympanicus*, is largely partitioned off from the tympanum proper, even in a state of health. The projecting horizontal folds of mucous membrane that mark the lower boundary of this region, the larger portions of the malleus and incus that help to form its floor, and the several ligaments that pass between these and the tympanic walls, all contribute to make the attic an almost distinct or accessory cavity. In the event of the complete isolation of this space by inflammatory swelling, the problem of its drainage becomes a very urgent and serious one, and unless it be promptly solved by artificial means the slow methods of nature will too often provide time for the extension of the disease to the antrum and mastoid cells. Even should not such extension take place, the occurrence of spontaneous perforation of the membrana flaccida is usually so long delayed that erosion and caries of the two larger ossicles will be almost inevitable. Another possible and much more dangerous outcome of this prolonged retention of the purulent secretion will be the carious perforation of the tegmen ty-

extremely thin plate of bone that forms the roof of the space and which alone serves to separate it from the cranial cavity. The almost certain result of such a communication between the two will be the development of an epidural or a temporosphenoidal abscess. If it shall happen that the ultimate opening in Shrapnell's membrane be one of considerable size we may very probably obtain a view of the neck of the malleus and perhaps a portion of its head ; and if, in addition, there has been extensive carious destruction of that portion of the border of the squama—the *margo tympanicus*—that forms the upper segment of the tym-

FIG. 113.



Prussak's space, section through the tympanic membrane, malleus, upper and outer tympanic wall of a decalcified preparation. (POLITZER.)

LS. Superior ligament of the malleus. LE. External ligament of the malleus. S. Shrapnell's membrane, or the membrana flaccida. O. Prussak's space. R. System of cavities between the body of the malleus and the incus and the external tympanic wall. T. Tendon of tensor tympani muscle.

panic ring, a much larger portion of the attic will be open to inspection. Instead, however, of finding exposed to our view the head of the malleus as well as the body of the incus, we may discover that they have both been quite destroyed by disease, and that we are looking into an almost empty cavity. It is not unusual, however, to find, as mementos of the departed bones, a group of granulations or at times one or more polyps.

The deafness which attends suppuration within the attic is apt to be more profound than when the disease is limited to the atrium—the lower portion of the tympanum ; and this is

explained by the fact that the ossicular joints are much more intimately involved in the inflammatory process, and that their integrity and mobility are thereby much more likely to be seriously compromised. Their movements are also apt to be greatly hampered by the thickening of the mucosa and its reduplications as well as by the formation of adhesions.

Patients who suffer from this variety of tympanic suppuration are also more frequently afflicted with dizziness and vertiginous attacks. In all probability this is due to the greater disturbance of the stapedial junction with the oval window and to the direct transmission of the irritation to the vestibule and labyrinthine structures.

In the examination of these cases the judicious use of the probe is capable of affording us much valuable information. We are not only enabled to detect with it the existence of any carious areas upon the ossicles or the tympanic walls, but we may also test with it the degree of ankylosis of the ossicular articulations and discover the presence of any adhesions that may help to immobilize them.

With reference to the prognosis, account is to be taken of the patient's general health, for this will exert a very decided influence upon the effect of the measures that we may employ for the arrest of the chronic suppurative process. If it be defective in any way, treatment that would otherwise be successful in controlling the local disease may prove altogether disappointing. Tuberculosis, syphilis, and certain other diathetic departures from perfect health will often neutralize the best efforts of that shortsighted specialist who regards everything beyond the limits of his little field of work as beneath notice. The prognosis is naturally less favorable in cases of long standing which show serious pathological change than in those which are of comparatively recent origin, and which as yet are marked by no great amount of injury. Of the several symptoms, those that may be regarded as of specially unfavorable significance are an obstinate profuse-

ness of discharge, its possession of an offensive odor, and a brownish discoloration of it, due to the presence of more or less blood. The existence of granulations or polypi will also darken the prospect of a prompt cure, and likewise the presence in the discharge of masses of cheesy material which arouse the suspicion of cholesteatomatous formations in the cavities connected with the tympanum.

Treatment. Of the several therapeutic indications that demand fulfilment if we would arrest a chronic suppurative otitis media, that which is of pre-eminent importance is the provision of free drainage. With this secured, the thorough cleansing of the diseased tympanum at proper intervals will become an easy matter, and the effect of the agents that are subsequently applied for the purpose of subduing the inflammation and its purulent secretion will be greatly increased. Before detailing the methods by which these results may be most often obtained, I venture once more to extol the value of the collateral treatment of the nose and nasopharynx. The neglect of the catarrhal disturbance in these cavities that, it may be said, is invariably coexistent with the otitis, will at least hamper, if it does not actually defeat, the curative purpose of strictly aural measures. As related to this, the general health, also, should be invigorated as much as possible, so that improved tissue nutrition and vitality may render material aid in overcoming the morbid process.

The freedom and completeness of the drainage of the middle ear will depend upon the size and location of the opening in the drumhead. If this be either so small that it interferes with the prompt escape of the pus, or if situated at so high a point in the membrana that the discharge represents but the overflow from the always full lower portion of the chamber, it should be at once enlarged sufficiently to remove either or both of these faults. As soon as this most essential feature of the treatment has been secured, the thorough cleansing and antiseptic of the tympanic cavity can be effectually carried out. In the management of

these chronic otorrheas one of two methods of treatment may be adopted, either the "wet" or the "dry;" but even should the latter be selected, a careful washing of the tympanum at the patient's first visit has always seemed to me a highly desirable preliminary. For this purpose a warm, sterile antiseptic solution should be used with the syringe, the particular antiseptic employed being largely a matter of fancy. Boric acid, 3 per cent.; carbolic acid, 2 per cent.; permanganate of potash, 5 per cent.; bichloride of mercury, 1 to 3000, or antinosin, 2 per cent., have all about equal antiseptic virtue: but, for other reasons, my experience has led me to prefer the antinosin solution. Any of these, with the exception of the mercuric chloride, may not only be syringed into the tympanum through the external auditory canal; but, to make the cleansing even more thorough, they may also be injected through the Eustachian tube with the aid of the catheter. By this latter procedure the tube as well as the tympanum is cleansed and disinfected. This is to be resorted to, however, only when the opening in the drumhead is of sufficient size to permit of the ready escape of the fluid. By these means we are usually able to remove from the middle ear all traces of morbid secretion. Should, however, the discharge be of a mucoid and tenacious character, and some portion of it obstinately remain in spite of the syringing, a few drops of a solution of hydrogen dioxide instilled into the ear will disintegrate and loosen it, and so facilitate its removal. The same effect may be obtained by using in the place of this a one-half per cent. solution of potassium iodide. When at last we are satisfied that complete cleansing has been effected, the auditory canal, the remaining portion of the membrana, and any exposed area of the tympanum are gently mopped to dryness with sterile or antiseptic cotton, and, with the aid of the probe, a thorough search is then made for granulations, polypi, or denuded and carious spots upon the ossicles or the inner wall of the tympanum. The discovery of these latter lesions will influence to

a great extent our subsequent choice of treatment. In the absence of any of these complicating features we usually have but to choose between the "wet" and "dry" methods of treatment. As a general guiding rule in the making of this selection it may be stated that when the discharge is not only profuse, but of rather thick and ropy consistence, and when, moreover, the opening in the drumhead is of such size as to permit of easy medication of the tympanum with aqueous solutions of astringents and antiseptics, the "wet" method will give the more favorable and rapid results. When, however, the discharge is both thin and scanty, and the perforation of the membrana is small, the "dry" treatment will be apt to prove the more satisfactory and successful of the two. This rule is of course subject to many exceptions, and the details of the two systems of treatment will often be modified in order to the more accurately adapt them to some special features presented by individual cases.

The wet method as usually carried out involves the daily flushing and cleansing of the ear with an antiseptic solution in the manner already described. The drying of the meatus and tympanum with the sterile cotton tuft is then followed by the instillation of a solution containing antiseptics or astringents or both. The metallic astringents most commonly employed are the sulphates of zinc, copper, and lead. A 1 per cent. aqueous solution of these—containing, also, a drachm of glycerin to the ounce—is about the average strength used, and when the liquid has been properly warmed, six or eight drops of it are introduced into the canals and permitted to remain for a few minutes. Although these remedies have lost little of their long-established popularity, I seldom resort to them myself, because of their astringent action being limited to a very brief period, by their forming insoluble precipitates with the secretion as soon as it reappears. My own experience has led me to greatly prefer the action of alcoholic instillations, these being followed by the insufflation of one of the antiseptic powders. The antiseptic power of the

alcohol may be increased by adding to it 3 per cent. of boric acid, and its dehydrating and reducing effect upon the engorgement of the mucosa is of great value. The ability which it possesses of penetrating to otherwise inaccessible recesses of the tympanic cavity is an additional point in its favor, and it will often, of itself, prove sufficient to devitalize and destroy the softer granulations and polyps. Because of possible pain it should be used at first in a not greater than 50 per cent. strength, but the rapidly acquired tolerance of the patient permits of a proportionately rapid increase of this strength. The only contraindications to its employment are the presence of *acute* congestion within the tympanum and the existence of mastoid tenderness, or of carious or necrotic areas upon the ossicles or the bony walls of the tympanum. Ten or a dozen drops of the boro-alcoholic solution should be instilled into the meatus and allowed to remain for some several minutes. The ear is then emptied and dried, and this is followed by the insufflation of a little boric acid combined with iodoform, nosophen, salicylic acid (2 grains to the drachm), or any of the other desiccative and antiseptic powders. The dressing is completed by loosely packing the canal with Haug's chinolin-naphthol gauze, which will not only protect the ear from external infection, but the capillary action of which will also promote drainage. This routine cleansing and medication may be repeated at first two or three times each day, according to the abundance of the discharge, and later, in proportion to the diminution of the discharge, the intervals between the treatments should be lengthened.

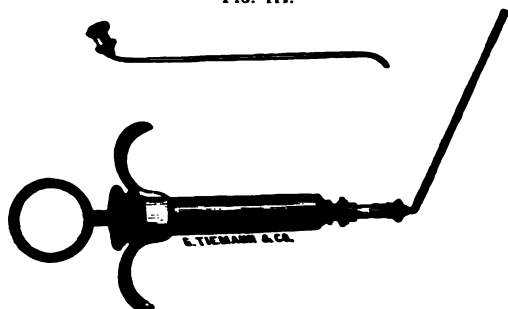
The technique of the "dry" differs from that of the "wet" treatment only in the omission of the preliminary irrigation of the ear by means of the syringe and the antiseptic solution. In the cases to which this dry method is most applicable, the perforation in the membrana tympani being small and the purulent secretion slight in amount, a sufficiently complete cleansing of the canal and drumhead may be obtained by mopping them indus-

triously with tufts of sterile absorbent cotton upon the applicator. One of these is then moistened with any one of the antiseptic solutions already mentioned, and the parts are gently but repeatedly rubbed with this until approximate asepsis is secured. A light insufflation of nosophen, iodomuth, or one of the other powders having antiseptic properties follows, and the dressing is again completed by the packing of the canal with the chinolin-naphthol gauze. This material is highly antiseptic and deodorant, and it should be carried to the fundus of the canal and brought almost in contact with the drumhead. The more nearly it approaches this point the greater will be the capillary suction power that it exerts. Care should be taken to change this gauze packing as soon as it becomes saturated with the discharge, because should it be permitted to remain after it has reached this condition it becomes an impediment instead of an aid to drainage. In those cases in which the perforation is situated in the upper part of the membrana, and in which, on account of the scantiness of the discharge, its enlargement does not seem to be called for, the preliminary withdrawal of any secretion that may have accumulated in that portion of the tympanic chamber below the perforation may often be effected by the use of the Siegle pneumatic speculum in conjunction with the Delstanche masseur. By repeatedly exhausting the air in the external canal by this apparatus any retained liquid secretion in the tympanum will be drawn through the opening in the drumhead and the cavity practically emptied. The subsequent cleansing and packing of the canal are then carried out as already described. If, after a month or six weeks of continuous and conscientious application of this treatment, our efforts are not rewarded by complete cure or by an encouraging amount of improvement, a resort to surgical procedures will probably become necessary.

When it is the attic instead of the atrium that is the seat of the chronic suppurative process, and the perforation, usually small, is found in the membrana flaccida, the ordinary means of cleans-

ing the middle ear will be found inefficient. The special syringe devised by Blake for washing out the attic, or the ingenious and useful apparatus of Hewitt, may either or both be resorted to in these cases, and will often afford us very satisfactory results.

FIG. 114.



Blake's middle-ear syringe.

Their safe and successful employment requires a very steady hand and the best possible illumination. An aqueous solution of boric acid is to be first syringed into the attic, and this followed

FIG. 115.



Hewitt's apparatus for washing out the attic.

by a dilute solution of hydrogen dioxide. In a few minutes the boric solution will be again used, and afterward, by means of the combined Siegle otoscope and Delstanche masseur, the cavity is to be emptied as completely as possible. This having been

accomplished, the attic is prepared for medication, and the solution best adapted to the larger number of these cases is that of boric acid and iodoform in varying strengths of alcohol. It may be well to repeat that these solutions should always be properly warmed before they are introduced, and that the force used in their injection should be very moderate. Should too much vigor be employed the patient may experience severe vertigo, and perhaps fall from his chair. In case the opening in the membrana flaccida is of sufficient size it may be of additional advantage to insufflate into the attic a little very finely powdered boric acid.

In cases of chronic otorrhœa that are marked by nothing more than the persistent purulent discharge, the treatment that has been detailed will, in the majority of them, prove successful in arresting it. In those cases, however, in which the suppuration has been of long continuance previous to the adoption of treatment, it is a by no means infrequent occurrence to find either the drumhead, the inner tympanic walls, or even the walls of the canal itself studded with granulations of varying size. It is true that the alcoholic instillations that have been recommended will often lead to the devitalization and gradual disappearance of these, but should they decline to yield to them they will serve to maintain the suppurative process, and they must be removed either instrumentally or by the application of caustics. It is only the well-trained eye and hand that can safely undertake the removal or destruction of these minute growths, and none other should attempt it. Caustics should be first employed, and as between chromic acid, nitrate of silver, trichloroacetic acid, chloride of zinc, and the perchloride of iron the first will be found the most efficient. After preliminary cleansing of the canal and tympanum the granulations are mopped once or twice with a 6 per cent. solution of cocaine, and, a few minutes later, well dried. A small crystal of the chromic acid is fused upon the tip of a delicate probe and the larger granulations separately and lightly

touched with it. Brilliant illumination should be provided for this little procedure, and care should be taken that the caustic comes in contact with nothing but the granulations themselves. One or two applications of this acid will usually prove sufficient to effect a cure of this condition. The pain it occasions is scarcely noticeable, but until the separation of the small sloughs that follow upon its use occurs, secretion from the ear is apt to be somewhat increased, and it may be necessary to cleanse it and to insufflate an antiseptic and desiccant powder a little more frequently than before.

At times the tympanic mucous membrane will seem to have undergone a polypoid degeneration, the granulations being unusually large and numerous. In such cases, instead of consuming time by a number of repetitions of the caustic acid, it will be

FIG. 116.



decidedly preferable to at once remove the altered tissue by means of sharp spoons or curettes. When these are used, in addition to cocaineizing the membrane it should be brushed with a 1 to 2000 solution of adrenalin chloride. The ischæmia of the tissue that this latter solution secures will almost entirely avert hemorrhage and save us the annoyance of frequently interrupting the operation in order to remove the blood that would otherwise obscure the field. The galvanocautery point has no special advantage as a destructive agent over the methods already suggested, and its employment would be dangerous in any but the most expert hands.

Aural Polypi.

As a rule, these neoplastic bodies may be regarded as later and more or less altered developments of the granulations just

described. They vary very greatly in both number and size, and there is an equal amount of variation as regards their situation. A single polyp is probably most often found, but two, three, or a half-dozen are not at all infrequent. Their number will usually be found to be proportionate to the length of standing of the suppurative disease. Their size, also, varies within wide limits. They may be quite minute with very slender pedicles, or one may be of such dimensions as to completely fill the external canal and to even emerge from this and appear in the concha. As to their situation, although, as a rule, they spring from some portion of the tympanic mucosa, it is not seldom that they are discovered growing from the outer surface of the drumhead or perhaps from the periosteum of the bony portion of the canal. It is not an uncommon occurrence to find a polyp, attached within the tympanum, protruding through the perforation in the membrana.

However they may vary in structure, the color of the aural polypus is usually pinkish or bright red ; but the nearer they approach the external orifice of the canal, or, in other words, the more greatly they are exposed, the paler do they become. In general conformation they may be smooth and club-shaped, or their surface may be papillated and quite uneven. At times the pedicle of the polyp is very slender, while at others it is broad and almost sessile. The epithelial covering of the growth usually corresponds to that of the surface from which it originates, and hence should it be attached to the walls of the tympanum its epithelial envelopment will be of the columnar ciliated variety ; while should it spring from the dermoid layer of the drumhead its surface will present a stratified squamous epithelium.

The varieties of polypi that are of ordinary occurrence are :

1. The mucous polypus.
2. The fibroma.
3. The angioma.
4. The myxoma.

The relative frequency of occurrence of these different forms is indicated by the order in which they have been given. The first two are encountered quite often, the myxoma extremely seldom.

1. *Mucous Polypi*. In spite of the very common use of this name it is probable that the neoplasms to which it is given, and which usually grow from the tympanic mucous membrane, would be more accurately classified as adenomata. At times they resemble very closely, both macroscopically and histologically, the mucous polyp of the nose, but there are almost always present more or less well-defined evidences of glandular structure. Their general structure presents a rather loose areolar connective-tissue stroma, in the meshes of which are confined varying numbers of round and spindle-shaped cells. It is not unusual for them to have a somewhat dense epithelial capsule, and it is the reduplications of this that give them their glandular character. Occasionally one or more of these glands may be found to have become isolated in the substance of the growth and to have undergone a cystic degeneration. These cyst-like spaces are usually regarded as retention-cysts, and not very rarely may be of such size that they can be detected with the naked eye.

The appearance of this form of neoplasm is ordinarily that of a somewhat pear-shaped growth, smooth, though at times lobulated, and of a pale pinkish or livid color. Its vascular supply is of generous proportions and the type of its epithelial covering is found to vary with the point at which it is examined. Toward its point of attachment, for example, the epithelium is apt to be columnar and ciliated, while that covering its free extremity is of the stratified-pavement variety. They easily yield beneath the touch of the probe, but are, as a rule, highly elastic. They occur in association with long-standing otorrheas, and most often grow from the anterior portions of the middle ear.

It is not improbable that they now and then become transformed into fibromata as a consequence of a reduction of their

blood-supply and the gradual alteration of their cellular elements into spindle cells and connective-tissue fibres.

2. *Fibromata*. Like the growth just described, the fibroma almost invariably occurs in association with chronic exudative inflammations of the middle ear. Perforation of the membrana tympani and the coexistence of a purulent discharge are doubtless always present, in spite of the claim sometimes made that this neoplasm may develop within the tympanic cavity behind an intact drumhead. With reference to the density of their structure, we distinguish between firm and soft fibromata. In the first the tissues may exhibit a distinctly areolar arrangement, and at times we may discover cystic spaces within them which have been occasioned by the growing together of adjacent lobules. The texture of the firm fibroma is more compact than that of the soft variety, its fibrous elements are more closely interwoven, and its vascular supply is much less abundant.

3. *Angiomata*. Certain of the soft fibromata have such an extremely rich vascular supply that they have been classed under the angiomata. In these the capillaries are very few in number, and in their place we find a network of blood spaces into which the blood empties directly from the arterioles, and from which it is discharged directly into the veins. In spite of this peculiarity of their vascular arrangement, so large an amount of fibrous connective tissue is included in the structure of these growths that it would probably be more accurate pathologically to term them angiofibromata.

4. *Myxomata*. This type of growth is encountered with extreme rarity. The stroma consists of a homogeneous gelatinous substance containing considerable mucin, and in it are found numbers of spindle-shaped and round, granular cells, the latter resembling lymph corpuscles.

Before leaving the pathology of these growths it may be well to have a clear understanding of the fact that by the general term "aural polypi" we mean those distinctly neoplastic formations

that originate within the middle ear or in the external auditory canal, which are pedunculated, and the component histological elements of which are of the softer connective-tissue type. Exuberant granulations which grow from a broad base are usually referred to as "polypoid proliferations," to distinguish them from the pedunculated new formations.

Symptoms. The presence and prominence of symptoms which suggest the existence of aural polypi will depend very largely upon their size or number and upon the extent to which they interfere with the escape of the purulent secretion. Should they be both few and small, and should they occasion very little if any obstruction to the concomitant otorrhœa, the only symptom that may be in evidence will be the occasional staining of the discharge with a little blood. In case, however, the polyp or polyps so occlude the canal that they seriously interfere with drainage from the middle ear, all the symptoms that attend retention of secretion and the pressure that it occasions will successively make their appearance. The patient is conscious of a sensation of fulness or distention in the head, the deafness is intensified, and to these may be added tinnitus and vertigo, nausea and vomiting, severe occipital as well as aural pain, facial paralysis, epileptiform seizures, unsteadiness of gait, and frequent attacks of faintness. Most of these reflex symptoms are due to the peripheral irritation occasioned by the obstructive polypus, and usually promptly disappear upon its removal and the re-establishment of drainage. Should it, however, be permitted to remain for any length of time, the imprisoned pus makes its way into the attic and antrum, caries and necrosis of the contiguous bony structures is apt to result, and mastoid disease and intracranial invasion are not unlikely complications.

Diagnosis. It is not always an easy matter to assure one's self of the nature and point of attachment of a growth that is discovered within the ear. To facilitate the diagnosis it will be first essential to thoroughly cleanse the canal. Owing to the frequent

presence of masses of clotted secretion mingled with desquamated epithelium, the use of the syringe will usually be necessary to secure their removal and the complete exposure of the polyp. The canal and its contents are then brightly illuminated and are gently mopped dry by the cotton-carrier. Definite information as to the point of attachment of the polypus may at times be obtained through ocular inspection alone, but, as a rule, it will be found necessary to enlist the aid of the probe. With this instrument we can ordinarily locate with much accuracy the smaller growths situated in the middle ear or the inner portion of the canal. When, however, the polyp fills the lumen of the canal and perhaps projects some distance toward its external orifice, we must rely largely upon the delicacy of our sense of touch in connection with the use of the probe. In such a case the probe may be cautiously introduced for some distance along the floor of the canal, and then slowly carried around the whole circumference of the growth. If neither the pedicle nor any adhesion be encountered the probe may be introduced a little further and the manoeuvre repeated. Should no obstruction to this complete circuit of the probe be met with by the time its depth in the canal has reached the limit of safety, we may conclude that the growth springs either from the inner extremity of the bony meatus, or from the membrana tympani, or from the cavity of the middle ear itself. It is only after its removal that we can learn with certainty from which of these three possible points the growth has originated.

In the majority of cases inspection combined with the use of the probe will enable us to decide pretty accurately as to the character of the growth. A rather pale fibroma with a more than ordinarily broad base may resemble in its appearance an exostosis. The probe, however, by revealing its mobility and a consistence that permits yielding beneath light or firm pressure, will distinguish it from the bony protuberance which is not only immovable, but which will prove resistant to any amount of pressure.

Sebaceous tumors are not apt to be encountered in the auditory meatus ; but should one be present, and by its prominence and configuration resemble a polypus, the probe will show that it is not pedunculated, and that it is, therefore, comparatively immobile. The absence of discharge, also, in connection with the sebaceous swelling, will be of diagnostic value.

It seems scarcely likely that an acute furuncle could be mistaken for a polypus, but in case of doubt the probe will elicit so much pain from the former that this of itself will usually be sufficient to resolve the doubt. In addition, however, the probe will show so clearly the difference in the nature of their respective attachments that we can scarcely have any difficulty in discriminating between the two.

The less experienced may have some trouble in distinguishing between a reddened and bulging drumhead and a deep-seated and highly vascular polypus. The use of the naked probe for diagnostic purposes in such an instance might be hazardous, but if its tip be protected by a shred of cotton its gentle use under bright illumination may be depended upon to remove any doubt.

It is not impossible that a polypoid proliferation from a beginning sarcoma or epithelioma may be mistaken for a simple polypus. Even previous to the microscopical examination of a portion of the growth, however, we will be justified in strongly suspecting its malignant nature by the scantiness and foulness of the purulent discharge, by the frequency and volume of bleeding, by the age of the patient, the early cachexia, and the intense pain that is almost invariably present. The sensation imparted through the probe to the fingers is also very different from that derived from an ordinary polypus, and the malignant growth will be found much more fragile and brittle to pressure than the benign.

Prognosis. With reference to prognosis, in addition to the character of the growth which will naturally exert the most marked influence, we must also take into account its point of

attachment which will affect the ease and completeness of its removal, and, finally, the concomitant changes that are present either within the ear or in its immediate neighborhood. When polypi are found protruding from a suppurating and carious attic the prospect of prompt and permanent cure is by no means bright. Without a resort to radical measures, not only is their thorough removal a matter of great difficulty, if not impossibility, but even after their partial removal we cannot so effectively treat their bases as to assure their non-recurrence.

Treatment. The object of the treatment of polypi is twofold, since it contemplates, in the first place, their destruction or removal, and, in the second, the prevention of their recurrence. Concerning the accomplishment of the latter purpose, it will be of practical utility to remember that these neoplasms almost invariably spring from an inflammatory soil. This seems to be essential to their origin and growth, and, therefore, it logically follows that if we destroy the fertility of this soil by removing the inflammation, we will at one and the same time arrest the further nutrition of polypi already present and discourage the development of new ones. If our efforts to effect this alteration are successful, it is not at all infrequent for polypi of considerable size to gradually atrophy and finally to become spontaneously detached. In those cases, however, in which the polypus is of such size as to seriously impede drainage and so to precipitate all the menacing complications that this may occasion, we cannot afford to wait for a reduction of nutrition to slowly lead to its wasting and self-detachment. Every hour of delay will be pregnant with danger. There is but one indication—immediate removal by operation.

We are at no loss for instruments with which to effect the removal of polypi. A wide choice lies between slender, probe-pointed knives, delicate-bladed angular scissors, ring-knives, sharp ring-curettes, sharp spoons, and, finally, snares. The selection of the particular form of instrument will largely depend

upon the size, the density, and the point of attachment of the polypus. Previous to any operation the canal should be prepared for its performance. Thorough cleansing and asepsis of the canal should be secured by syringing it with warm antiseptic solutions, and it should then be mopped dry with the sterile cotton tuft upon the applicator. Although the instrumental removal of a polypus is usually productive of but little pain, even this little may be rendered less by the use of cocaine and the solution of adrenalin chloride. The first should be in 4 per cent. solution, the latter in 1 to 2000. The adrenalin is of very great assistance in this operation, since by its power to almost completely prevent hemorrhage the limited field of operation is unobscured, and our work is rendered the more rapid and complete. If this agent be not used the bleeding may be pretty smart at times, and our progress will be frequently interrupted by the necessity for removing the blood from the canal so that we may see what we have accomplished. It has an additional advantage in that, by emptying the vessels of the growth, it so reduces its size that it may be the more easily ensnared by the wire loop or encompassed by the ring-knife or curette. Should the polypus not be of such size as to completely fill the lumen of the canal, both the adrenalin and cocaine are better applied to it by means of the cotton-carrier than by instilling an unnecessarily large quantity of the two solutions into the canal.

The smaller and softer growths that originate upon the walls of the canal are usually most easily removed by the ring-knife of Politzer or the sharp ring-curettes of Buck. One or the other of these instruments is to be slipped over the body of the growth, carried down to its pedicle, and this latter, by a quick movement, severed.

If the polypus be more bulky, however, of firmer consistence, and with a somewhat broader pedicle, the snare will be the safer and more satisfactory instrument to employ. As compared with the original snare devised by Wilde, that which may now be pro-

cured (Fig. 117) is a very great improvement. It is light, yet firm, and the canula is so slender that it occupies but little space in the meatus, and, therefore, obstructs our view very slightly. It is highly important that an appropriate variety of wire be selected for use with this instrument. Even the finest steel wire that is obtainable is usually too stout and inflexible for this delicate work. Silver, also, is apt to be unsatisfactory, because a wire that may be of sufficient firmness will probably have too little resiliency to retain the desired curve of the loop. A slender brass wire, either that used by harnessmakers or that employed by the surgical instrument maker for clearing hypodermic needles, is for the removal of the majority of polypi the most satisfactory material. It has enough spring to give firmness to the loop, and

FIG. 117.



Blake's polypus snare.

enough strength to cut through the average pedicle without breaking. The snare then is armed with this wire, the loop left at the tip of the canula being just a shade larger than the girth of the body over which it is to be slipped.

The largest sized speculum that the meatus will admit should be selected, the light should be brilliant, and the patient's head so supported that it will be perfectly steady. The slightest movement on his part will almost certainly throw the polypus into shadow and put a temporary stop to our manœuvring. For this reason, in the average child, and in the occasional adult without self-control, general anæsthesia will be advisable, if not imperative, and a resort to this will of course render necessary the employment of the electric head-lamp.

The snaring of an aural polypus is by no means a simple and easy matter, and the skill that is essential for successfully encircling the growth with the wire loop and for the snug adjustment of this about the pedicle is not to be acquired from our first one or two operations. The difficulties that beset the beginner are those that attend the constant maintenance of the illumination, the steadiness of hand that will protect the sensitive cutaneous lining of the canal from unnecessary contact with the wire, and the ability to so manipulate the instrument that the loop will get well down to the base of the growth and be retained there during its retraction, so that the whole neoplasm shall be removed instead of but a portion of it. These very real difficulties can be minimized only with much practice.

When the pedicle has been cut through, the detached growth will usually remain in the grasp of the instrument and be removed with it. Should it, however, escape from it, it may be readily extracted by an angular forceps or the blunt ring-curette. If the adrenalin solution has been well applied to the polypus previous to the operation there will seldom be any hemorrhage worth mentioning. Should it occur, however, it can be almost immediately arrested by holding for a moment a small tuft of cotton, wet with the same solution, in contact with the oozing stump. To complete the destruction of the growth and so to prevent its recurrence, this remnant of it is now mopped dry and lightly touched with the crystal of chromic acid fused upon the tip of a probe. The application of the caustic is followed by the insufflation of one of the antiseptic powders—nosophen or boric acid, either alone or combined with iodoform—and the canal is then stopped with an antiseptic gauze or cotton. At the end of a few days the slough occasioned by the caustic will be thrown off, and only the cicatrix will remain.

The removal of one polypus may disclose another or others that have hitherto been concealed. These will of course be successively snared and their bases cauterized like that of the first.

The improved access to the tympanum which the clearing of the canal of these growths will afford will often enable us to quickly arrest a suppurative process that otherwise, doubtless, would have persisted indefinitely.

In those occasional cases in which we find a polypus attached within the cavity of the middle ear, and projecting through and almost filling the perforation in the membrana tympani, it will be labor lost to attempt to remove the growth properly without sufficiently enlarging the perforation to permit of our reaching the pedicle.

If, after the removal of all granulations and polypi, several weeks' continuance of the treatment that has been described for the ear, as well as for the nose and nasopharynx, shall fail to arrest the suppurative process, we may reasonably suspect the existence of caries or necrosis, perhaps both, of the ossicles or tympanic walls.

Purulent inflammation of the ear which occurs as a complication of some prolonged and exhausting disease, or is secondary to one of the acute infectious fevers, although it may not be marked by any unusual violence, is particularly prone to lead to destruction of the ossicles and possibly to grave disease of the temporal bone, even in the absence of any predisposing constitutional state. It is this tendency that will account for many of those serious bone affections that occur in an otherwise apparently trifling otitis media that accompanies an attack of scarlet or typhoid fever.

Although primary inflammation of the osseous tissue of the auditory ossicles is extremely rare, its secondary implication is by no means uncommon. If it be recalled that the mucous membrane lining the walls of the tympanum acts also as the periosteum of the ossicles, we will not be at a loss to understand why a purulent inflammation of this membrane is so liable to eventuate in destructive disease of these minute bones. The nutrition of the ossicles being derived entirely from the vessels of the

mucous membrane, any disease of the latter that may occasion the destruction or obliteration of these vessels will almost inevitably lead to death of the bones. Suppurative inflammation of the attic is especially apt to be attended by ossicular caries or necrosis because of the difficulty and incompleteness of drainage from this portion of the ear. With the bodies and the articulation of the malleus and incus constantly bathed in pus, it is but to be expected that they will sooner or later yield to the necrosing action of this secretion itself or of the pathogenic organisms that it contains.

It is in the manner by which they are affected by caries and necrotic processes that the ossicles resemble the "long bones." It is their articular extremities, for instance, that, like the epiphyses of the long bones, are most frequently attacked by caries; while, on the other hand, it is their long and slender processes that more often succumb to necrosis, just as do the diaphyses of the long bones. The portions that most often exhibit the effects of necrosis are the handle of the malleus, in part or in whole, and the corresponding process of the incus. While these parts are undergoing a gradual destruction the articular ends of the two bones may be either entirely free from disease or display but a limited loss of their substance.

The fact that of the malleus and incus the former is the one that is more commonly affected by caries and necrosis is due to the almost invariably profound involvement of the membrana tympani in all inflammatory disturbances of the middle ear. It is the very close attachment between the manubrium and the membrane that exposes the vitality of the handle to such serious risk. The incus, however, is likewise menaced by its intimate relationship with the malleus, and it is not seldom affected secondarily by the extension of disease from the latter bone. Of the three bones, therefore, it is evidently the stapes that is the most favorably situated from a pathological point of view. At long intervals, nevertheless, even this bonelet participates in an

aggressively destructive process, and may lose its crura as the result of it. Fortunately, however, its foot-plate, which is a protective bulwark against purulent invasion of the internal ear, is often preserved from the general disaster.

The subjective symptoms accompanying caries or necrosis of the ossicles are too uncertain, too variable, to be of any distinct diagnostic value. It is, as a rule, only by the careful use of the probe, and the discovery therewith of denuded bone, that we are enabled to assure ourselves of the existence of this complicating feature of a rebellious suppurative otitis. Should it be definitely ascertained, then, that one or more of the ossicles are diseased, there should be no hesitation or delay in removing them. In such cases, the membrana, also, has shared in the injurious effects of the prolonged suppuration. Whatever may remain of it is thickened and studded with granulations, and it can no longer be regarded as an aid to audition. On the contrary, it is much more apt to impede than to favor the transmission of the sound waves to the labyrinth, and it may be additionally objectionable as a hindrance to free drainage. Its removal in conjunction with the diseased ossicles will, therefore, be justified by established surgical principles, and will, moreover, greatly facilitate subsequent cleansing and medication of the middle-ear cavity.

Excision of the Membrana Tympani and Ossicula.

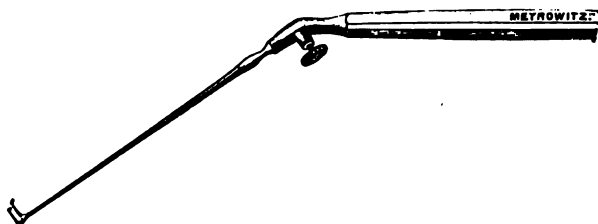
Except in children and in timid, neurotic adults, or in those cases in which the perforation in the drumhead is so small as to prevent the entrance of a cocaine solution to the tympanic cavity, there is no imperative necessity, for the successful performance of this operation, for general anæsthesia. Since the addition of adrenalin chloride to our list of surgical accessories, ossiculectomy has been greatly simplified and the time required for its performance materially shortened. The preliminary introduction of a half-dozen drops of a 1 to 2000 solution of adrenalin not only produces a profound ischæmia of the engorged tympanic mucosa,

but it shrinks it to such an extent that the contracted space in which we are to conduct our operative manipulations is considerably widened. The local anæsthetic effect of the subsequently introduced cocaine solution will also be emphasized and its possible toxic effects minimized. As in all other surgical procedures, the preparation of the ear for this operation will include its thorough cleansing and the most complete antisepsis that is obtainable. It may first be syringed for some minutes with a 1 to 3000 bichloride solution, and then, if it should seem at all desirable, some hydrogen dioxide is to be instilled into the meatus and retained for a minute or two. The sublimate solution is now again used, and the ear is afterward thoroughly dried with mops of sterile absorbent cotton. The tympanic cavity is now ready for the instillation of the solution of adrenalin chloride. This should be of about 1 to 2000 strength, and, shortly before it is used, should be rendered perfectly sterile. Five or six drops are to be introduced into the tympanum, the head being inclined toward the opposite side, and three minutes will be an ample allowance of time for it to fully exert its remarkable powers upon the mucous membrane. The position of the head being now reversed, and the adrenalin solution permitted to drain from the ear, it is quickly replaced by the same quantity of a 6 per cent. solution of cocaine. Should it seem desirable, this may be repeated at the end of three minutes, and after another five minutes it will usually be found that the tissues are quite sufficiently anæsthetized to permit of the performance of the operation without either noticeable pain or hemorrhage, and therefore without interruption. The ear is again carefully mopped with antiseptic cotton until dry, and the head is now supported by an assistant to ensure steadiness.

Any remaining portion of the membrana should first be removed by an incision along its periphery close to the bony insertion. The next step in the operation will depend upon the extent upon the degree of ossification that has taken

ossicles. Should we find that the greater portion of the malleus and incus is still present, it is, as a rule, the latter that will be preferably first extracted. If precedence be given to the removal of the malleus the unsupported incus may fall from its place and be lost to view in the depressions of the tympanic floor. The extraction of the incus is accomplished by first dividing its articulation with the stapes by passing an incus hook knife beyond the long process of this bone, drawing it gently outward, and then rotating the blade so that it passes between the two surfaces. The loosened process may now be seized by forceps and the bone drawn cautiously downward and outward into the canal. Little force is required to rupture its superior attachments. Should it

FIG. 118.



Hewitt's incus hook.

be found, however, that the long process of the incus has already been destroyed, our attention should be turned to the malleus and the attachments of this bone be successively divided. Any adhesions that have formed between it and the inner wall of the tympanum must also be severed before any traction is made upon it. Upon the completion of this preliminary loosening of the bone, its handle, or what remains of it, is to be grasped by forceps and the bone drawn from its bed by downward and outward traction. As a rule, the body of the incus in these cases will be found adherent to the head of the malleus, and will be removed with it when the latter bone is extracted. Should the connection between them have been destroyed, however, and the body of the incus remain in the attic after the withdrawal of the malleus, it

must be separately searched for and removed. Of the several instruments that are more or less well adapted to this purpose the incus hook patterned by Hewitt is probably the most serviceable in the majority of cases. This is to be cautiously introduced within the attic, carried to the inner surface of the incus, and then drawn downward and outward. (Fig. 118.)

It is perhaps debatable whether, after the extraction of the ossicles, it is either necessary or prudent to remove by curettage any granulations that may be discovered in the attic or lower drum cavity. It cannot be denied that the risk of injuring the facial nerve is considerable. It not infrequently happens that during a prolonged suppurative inflammation of the middle ear the wall of the facial canal is thinned, or perhaps destroyed in part, and the contained nerve exposed. In such an event the incautious or unskilled use of the curette will be attended by very grave danger of producing a facial paralysis. In view of the facts, therefore, that a breach of the canal wall is at least a possibility, and that, should it exist, it cannot be detected by the eye, it would seem that a conservative course would be the more judicious, and that it will be better, for a time at least, to endeavor to secure the disappearance of the granulations and the arrest of the suppurative process by persevering with the cleansing and antiseptic measures that have been in use up to this time.

Upon the completion of the operation for the removal of the remnant drumhead and the diseased ossicles, the ear is repeatedly syringed with the bichloride solution, well dried, an antiseptic and desiccant powder—iodomuth or nosophen—insufflated, and the canal then loosely tamponed with an antiseptic gauze. The frequency of the removal of this dressing will depend upon the amount of discharge. It is not unusual for the purulent secretion to cease very shortly after this operation; but should it continue, in spite of active treatment, for more than six weeks or two months, we must contemplate a resort to further and more radical surgical procedures.

Cholesteatoma.

Although in an extremely limited number of instances this disease has been known to originate primarily, yet in the very large majority of cases it occurs as a complicating feature of prolonged suppurative disease of the middle ear and its accessory cavities. During the course of a chronic purulent otitis media it is not at all infrequent occurrence for the discharge, particularly when its escape is unimpeded, to contain numerous soft, cheesy masses of epithelial cells. So long as the exit of these is not hindered this active desquamative process may continue indefinitely without any noticeably harmful result. If, however, the development of granulations and polypi, or some other complicating accident, should lead to any obstruction of the escape of this cellular material and occasion its retention for any considerable period, it can scarcely fail to form masses of much greater size and to provoke symptoms indicative of more or less severe pressure. Pain, though not constant, is of common occurrence, and there may be, in addition, manifestations of cerebral disturbance, such, for instance, as vertigo and vomiting. If their presence be unrecognized and the treatment directed to the cure of the middle-ear suppuration should exert no restraining effect upon their growth, they may not only extend from their point of origin throughout all the several cavities that are in communication with the middle ear, but by gradual erosion of their bony boundaries they may invade the brain cavity and provoke intracranial complications. This accident is particularly apt to happen when the growing mass occupies the attic and exerts a constantly increasing pressure upon the thin tegmen tympani above it. The mucoperiosteal lining of the cavity is destroyed by ulceration, granulations form, and the bone itself undergoes absorption.

The cholesteatoma ordinarily met with is a more or less globular body, its shape being modified by that of the cavity in

which it grows. It is usually of a bluish-white or pale yellow color, and its size may reach that of a pigeon's egg. At times it is enveloped by a thin membranous capsule which has a bright, pearly lustre. Its substance is made up of a series of concentrically arranged laminae of densely packed epithelial cells which resemble those of the epidermis. Toward the centre of the mass a varying quantity of cheesy material may be found, which is composed of imprisoned pus and cells that have undergone a fatty degeneration. Between the lamellae numerous crystals of cholesterolin are found, intermingled with fat granules, micro-organisms, and now and then giant cells.

The process of formation of these cellular masses is still a subject of speculation and dispute. Pathologists are not yet in harmony as to either their nature or etiology. While some contend that these bodies found in the cavities of the temporal bone are of distinctly heteroplastic character, others insist that their pathogenesis comprises nothing more than a simple retention of inflammatory products from the spaces themselves. Still another faction asserts that the growths always originate in the external auditory canal, and that their presence in the attic, the antrum, or the mastoid cells is the result of extension from their primary site. This latter hypothesis is discredited, however, by the fact that there is one case on record in which a cholesteatoma of the tympanum was found without any trace of a pre-existent suppurative inflammation of that cavity or of a perforation of the membrana.

Of the several communicating spaces in which cholesteatomata may be found, it is probably for the mastoid cells that they exhibit the greatest predilection. When, however, under favoring conditions, the mass undergoes a continuous increase in size, the membranous and bony constrictions which serve as demarcations of the different cavities may be successively obliterated, and we find them transformed into one large chamber. Further progress of the growth externally may lead to extensive destruc-

tion of the margo tympani as well as of the postero-superior wall of the bony meatus.

The prominence of the symptoms accompanying cholesteatomata will be proportionate to their size and the amount of destructive pressure that they occasion. There is ordinarily a sense of distention and weight on the affected side, and to this may be added headache, vertiginous seizures, and perhaps vomiting. If relief be not afforded by the removal of the spreading mass, symptoms of intracranial mischief will, in all probability, sooner or later become manifest. Finally, if the usually concomitant suppuration remain unchecked, and the escape of the purulent secretion be, as it almost always is, seriously interfered with, absorption of pus, with consequent pyæmia or septicæmia, becomes inevitable. Meningitis, sinus phlebitis, and cerebral abscess are further possible events, and not a few cases of fatal hemorrhage, as the result of penetration of the lateral sinus and of erosion of the carotid artery, have been reported.

It is only from the objective appearances that a dependable diagnosis can be made; and since these, owing to the at times sequestered situation of the growth, are liable to be few and inconclusive, we are not infrequently left in considerable uncertainty. When, however, detached fragments of the epithelial mass are discovered in the purulent discharge from the middle ear; and when—of even greater significance—we can see them emerging from the atrium or attic through the perforation in the drumhead, our diagnosis of the cholesteatomata will be rendered much more definite and reliable. In place of this evidence, fistulous sinuses are occasionally found in the bony portion of the canal, and if these give exit to a discharge containing numerous epithelial cells, and with it there is associated more or less constant mastoid pain, we may be pretty sure of the nature of the disease with which we have to deal.

Treatment. The therapeutic indications include not only the early removal of the cholesteatomatous masses, but the arrest,

also, of the suppurative process that has occasioned them, and that, if allowed to continue, would encourage their recurrence. In many instances, especially if the perforation in the drumhead be large and the cholesteatomata are within easy sight and are of but moderate size, persevering syringing of the canal with a warm 1 to 3000 bichloride solution may be found sufficient to expel them. Should their hardness and density prove obstacles to their removal, they may first be softened and to a certain extent disintegrated by the use of hydrogen dioxide or of a combination of equal parts of alcohol and aniline oil. Although in those cases in which the epithelial masses occupy the atrium the ordinary ear syringe may be quite successful in effecting their removal, yet when they are impacted in the attic an instrument that will reach them more directly may be found necessary to dislodge them. For this purpose, either Blake's middle-ear syringe or Hewitt's apparatus for washing out the attic will usually prove of very great service. The opening in the membrana flaccida should first be enlarged, if necessary; then one of the softening solutions mentioned is to be introduced into the meatus and allowed to remain for some minutes, and immediately upon its removal the cavity of the attic should be well flushed by means of Blake's or Hewitt's instruments. If the cholesteatoma proves resistant to these methods, delicate hooks, ring-curettes, or spoons should be used with patient care until the mass has been loosened and broken into small fragments, when the syringe cannot fail to bring it away. It is well worth remembering that the instillation into the tympanum or attic of a few drops of an adrenalin solution is often of very great assistance in these cases because of its remarkable shrinking effect upon the swollen mucous membrane and the consequent increase of space afforded us in which to conduct our instrumental procedures. Although, when there is no such urgency of symptoms as would indicate the necessity for immediate operative relief, these attempts at the extraction of cholesteatomata through the natural passage should always be

given a fair trial, yet they should not be persisted in for an unreasonably long time, because of the possible development of one or more of the complications that have been mentioned. If several days' continuance of this treatment, therefore, be unattended by any decided improvement, and if, moreover, we have reason to believe that the antrum and mastoid cells are also implicated in the production and retention of the growth, we should lose no time in opening by operation these cavities, so that the offending masses may be completely removed and measures taken to prevent their reproduction.

Before entering upon a description of the diseases of the mastoid process and of the surgical procedures that they frequently demand, it will be opportune to consider at this point one or two of the secondary and perhaps permanent results of chronic purulent inflammation of the middle ear. Of these, that which is most frequently, indeed almost invariably, present is

Permanent Perforation of the Membrana Tympani.

The pathological importance of this lesion varies within wide limits. The symptoms logically attributable to it may be partially dependent upon several other conditions, and it is, therefore, difficult, if not impossible, to estimate with any accuracy the relative responsibility of each. If the drumhead were an entirely independent portion of the hearing apparatus some definite conclusion might be arrived at as to the effects produced by a permanent opening in it; but since it is not, the symptomatology of its defects must be studied in association with those of the other structural details of the sound-conducting mechanism. The degree of impairment of hearing, for instance, is very far from bearing a constant relation to the size of the perforation. A high degree of deafness may at times be associated with an opening of insignificant dimensions, while at others there may be absence of the major portion of the membrane with scarcely noticeable

impairment of audition. It is, in all probability, to the position and degree of mobility of the ossicular chain that we must look for the explanation of this seeming inconsistency.

In addition to the loss of hearing power, several other direct results of a persistent perforation of the membrana combine to make its closure desirable. Of these, one of the most pernicious is the susceptibility which it develops in the patient to acute inflammatory disturbance upon very trifling provocation. The protective value of the drumhead to the tympanic mucous membrane is clearly demonstrated by this increased tendency to acute inflammation of the middle ear which ensues upon its destruction. Again, the exposure of the mucous membrane of the tympanum to external irritants which is entailed by loss of the membrana leads, in time, to that sclerotic change in the mucosa which induces fixation of the ossicles and also gives rise to many annoying subjective sensations. Tinnitus and vertigo of severe type have, in a moderate number of cases, been entirely subdued by the closure of a long-existent perforation of the membrana. The inference is obvious.

So little success has attended the most painstaking and ingenious efforts to secure regeneration of extensively destroyed tympanic membranes, that it is questionable whether, particularly in those perforations the edges of which are densely cicatrized, it will not be better to be content with the often gratifying results that are obtained by the use of an artificial substitute for the crippled membrane. Quite a number of more or less efficient substitutes have been introduced since Yearsley, in 1848, announced that the hearing of one of his patients was very greatly improved when his external canal was partially closed by a cotton-wool plug or a quill of paper that was introduced until it came in contact with the drumhead.

Toynbee offered his artificial drum membrane to the profession some three or four years after Yearsley had suggested the probable value of such an instrument. It consists of a circular disk

of thin, flexible rubber, to the centre of which is attached a slender wire of about the length of the auditory canal. This attachment allows of its introduction by the patient and its placement in proper position. This ingenious instrument, however, although a decided improvement in some respects upon the cotton-wool plug and the paper quill, has certain disadvantages that limit both its safety and utility. The length of the wire that is essential in order that the patient may himself introduce and remove it prevents its being entirely hidden in the meatus, and its exposure in the outer ear renders the deeper structures liable to injury through any accidental disturbance of it. Moreover, it is not particularly durable, and even its initial expense places it beyond the reach of the poorer class of patients.

FIG. 119.



Toynbee's artificial drum membrane.

A thread is sometimes substituted for the wire, but this compels the use of forceps for its insertion and something more than the average amount of skill possessed by patients, in order that no injury may be inflicted. A final objection to this device is that it not infrequently occasions an annoying amount of irritation in the canal, and many patients complain of its easy displacement by the movements of the jaw in chewing.

For several reasons the twisted roll of cotton-wool is, in the majority of cases, much more satisfactory than the Toynbee drum membrane. Its introduction and removal can be effected without difficulty and without risk of harm, the patient can easily fashion it himself, and it is much less liable to displacement because of the more even support that is afforded its surface by the walls of the canal. It has a further advantage in that its employment is not contraindicated by the existence of a moderate amount of otorrhœa. In such cases its inner extremity may be thinly coated with an antiseptic ointment or a weak glycerite of carbolic acid. The improvement in hearing effected by this wick-shaped roll of wool is in a number of cases quite remarkable.

It is scarcely necessary to observe that previous to the introduction of any article of this kind the ear should be cleansed and dried. Any increase in the acuity of hearing will also be rendered the greater by a preliminary opening of the Eustachian tube by means of inflation through the catheter or by Politzerization. It is only to be expected that it will take the patient some little time to become accustomed to the presence of this foreign body in the canal; but, as a rule, he will soon become unconscious of any slightly unpleasant sensation that it may at first occasion. It may be advisable to have him retain it in position for only an hour or two the first few times it is applied, and to gradually lengthen this period with each repetition of its application. The making of this cotton wick and its insertion and withdrawal are all so simple that, if for no other purpose than that of cleanliness, it will be a good rule to have the patient remove the old each night and insert a new one in the morning.

There is a good deal of uncertainty, to say the least, concerning the exact mode of action by which the various substitutes for the destroyed membrana effect their improvement of the hearing power. Although there is still a rather wide difference of opinion concerning this interesting question, much the larger number of observers unite in opposing the view that it is merely through the closure, complete or partial, of the perforation that the increased hearing is obtained. In so far as the function of audition is concerned, it is extremely doubtful whether an artificial drum membrane can substitute the natural one in any other way than by restoring, to a greater or less extent, the normal tension of the ossicular chain. Should there be a solution of continuity at any point of this chain, the pressure exerted by an artificial membrane may serve in a measure to repair it, and this highly probable action seems to be exerted with particularly happy effect when there is a break in the connection between the tip of the long process of the malleus and the head of the incus. In spite of this repeated application the patient is still quite unable

to designate with any certainty the particular type of case that will be benefited by the adoption of an artificial drumhead.

Nevertheless, if its use is not specifically contraindicated by the existence of an abundant discharge or by its provoking an objectionable amount of irritation, it should be faithfully tried in all cases in which other methods of treatment have failed to increase the hearing distance. Less important perhaps than its beneficial effect upon the hearing function, but, notwithstanding, a very valuable attribute of the artificial drumhead, is the protection that it affords the sensitive intratympanic structures against external irritants. From this point of view it is a powerful prophylactic against the frequently recurring acute inflammations that are so commonly associated with extensive losses of substance of the membrana.

In a certain number of cases in which a fairly large portion of the drumhead still remains, and in which the exposure of the middle ear incident to the perforation leads to repeated attacks of inflammatory disturbance, it will be quite worth while to attempt to secure a regeneration of the destroyed portion of the membrana by one or more of several methods that have from time to time been employed with greater or less success. If the nutrition of the remnant is good and the edges of the perforation are not densely cicatrized, we may now and again effect its closure by touching its margin at several points with a bead of nitrate of silver fused upon the tip of a probe. The galvanocautery point applied in the same way has also proved highly effective in the hands of some operators. In the smaller perforations complete repair may often be obtained by the making of a number of incisions, $\frac{1}{2}$ to 1 mm. in length, close to their periphery and at right angles to it. A modification of the same measure has been employed at times with some success, in order to induce contraction of a relaxed cicatrix in the membrana. A defect of this kind is often accountable for frequent variations of the hearing function, it being good when the cicatrix is depressed, but

impaired when it is displaced outward. To restore the normal tension of this portion of the drumhead, multiple punctures instead of incisions may be made in it with a fine needle.

Caries and Necrosis of the Temporal Bone.

These diseases of the temporal bone occur with considerable frequency, because it must be an uncommonly mild attack of acute or chronic suppurative inflammation of the middle ear that is not accompanied by more or less periostitis and otitis of the immediately surrounding bony structures. We have seen how often the ossicles are affected by these destructive processes, and it is but a step further for them to assail the temporal bone itself.

The anatomical condition which favors this bone implication is the double duty performed by the tympanic mucosa in not only supplying a mucous lining for the middle ear, but in acting, also, as the periosteal covering of its bony walls. The fact that these affections are much more frequent in childhood than in adult life is doubtless due to the greater vascularity of the periosteal layer of the membrane during the earlier years of life, and to the greater number and size of the vessels that pass from it into the substance of the bones. It is, indeed, unusual for these bone complications to occur in adults who are in otherwise good general condition unless there has been a great want of care in securing and maintaining cleanliness of the external canal and the middle-ear cavity. To permit retention of the purulent secretion for any length of time is to favor its decomposition, the invasion of the tympanum by pathogenic micro-organisms, and the extension of the inflammatory process to the deeper tissues. The obliteration of many of its vessels and the separation of the periosteum from the bone are the succeeding steps that lead to the loss of the nutrition of the latter and to its consequent death. In tuberculous, syphilitic, and strumous individuals frequent cleansing and antiseptics of the ear must be carried out with particular care,

because these are the systemic conditions that predispose most strongly to the development of caries and necrosis.

The extent of bone that may be involved in these processes varies quite widely. It may be limited to a small spot upon the promontory of the internal wall of the tympanum, or it may implicate extensive areas of the mastoid, the petrous, or the squamous portions of the temporal bone. The fact that it is the spongy or cellular type of bone that is more liable to attack than the more compact or denser sort, accounts for the frequency with which the mastoid process is affected. Next to this in the frequency with which it is attacked is the bony portion of the external auditory canal, particularly its upper and posterior part, and a close third is the thin layer of bone forming the roof of the tympanic cavity. In the latter case intracranial complications are very likely to ensue, and of these meningitis and an extradural or temporosphenoidal abscess are the more common. Extensive destruction of the mastoid process may lead to exposure of and serious hemorrhage from the lateral sinus, or it may become thrombosed and eventuate in pyæmia or the formation of an abscess of the cerebellum. If, as is occasionally the case, the pars petrosa figures to any considerable extent in the disease, the labyrinth is apt to share in the injury inflicted and to provoke such symptoms as nausea, vomiting, tinnitus, severe pain, and vertigo.

One of the occasional incidents of a carious or necrotic process affecting the temporal bone is a paralysis of the facial nerve. One has but to recall the course of the aqueductus Fallopii to appreciate the ease with which a purulent inflammation of the middle ear can affect the integrity of this frail canal and menace the nerve within it. Although it is quite true, however, that in perhaps a large number of the cases of facial paralysis occurring in association with a purulent median otitis, the palsy is due to carious destruction of the Fallopian canal and to the subsequent involvement of the nerve in the inflammatory process, yet it has

been shown to have occurred so often without the slightest demonstrable lesion of the canal, that the diagnostic significance with reference to temporal caries and necrosis once attributed to this symptom has been very greatly diminished. Post-mortem as well as clinical observation has made it evident that facial paralysis may occur with an intact Fallopian canal as the result merely of an inflammation of the nerve sheath, the exudation attending this proving sufficient to compress and suspend the functional power of the trunk. Moreover, the pressure exerted by the retention of an inflammatory secretion within the tympanum itself may in rare instances suffice to occasion the palsy. Hence, although it is most often in connection with chronic purulent otitis that this symptom becomes manifest, yet it is far from impossible for it to occur as well in association with acute simple inflammations of the middle ear. It must not be inferred from anything that has been said, however, that absence of facial paralysis is at all a positive indication that the bone in the immediate vicinity of the nerve, or even the wall of the canal itself, is free from disease. On the contrary, cases have been reported in which, in spite of extensive carious destruction of its enveloping walls and its exposure for long periods to an irritating purulent secretion, the function of the nerve has remained entirely unimpaired.

The rapidity with which this symptom develops varies widely in different cases. It may appear during the acute stage of the otitis, or it may be delayed until the suppurative process has been chronic for many months. Again, its occurrence may be sudden and complete, without the coincidence of noticeable prodromes, or its appearance may be quite gradual and be preceded by an increase of pain in and behind the ear, tinnitus aurium, and perhaps disturbances of the sense of taste.

The course of caries and necrosis of the temporal bone will be largely influenced by the site of the disease, by the state of the general health of the patient, and, to a lesser extent, by his age.

In children the progress of the disease is apt to be much more acute than in adults, and its favorable or fatal termination, therefore, more prompt. In later life, although the separation of the diseased from the healthy bone may be quickly accomplished, yet the process of exfoliation may consume so much time that the patient may die of exhaustion consequent upon the prolonged purulent drain. The necrosed bone is in some cases thrown off *en masse*, while in others it comes away in fragments of varying size, which are discharged either through the external auditory canal or through one or more fistulous tracts that may have formed in its neighborhood. In case the disease ends fatally this termination may be brought about by some intracranial complication, by pyæmic infection, or by the erosion and perforation of some large bloodvessel, such as the carotid artery, the jugular vein, or the lateral sinus.

From a prognostic point of view, experience has shown that carious disease of the mastoid process is least inimical to a favorable result. A similar affection of the pars tympanica will naturally be attended by much more serious possibilities, because of its very intimate relations not only with the cranial cavity, but with the carotid artery and jugular vein. In the event of the disease involving the petrous portion of the temporal we can scarcely anticipate anything but a fatal termination. It does not need saying that the more vigorous the patient's general vitality the better will be his chances of accomplishing successfully and surviving the process of exfoliation. For this reason any constitutional disease, such as tuberculosis or syphilis, or the existence of any debilitating diathesis, will seriously impair his prospects of recovery.

The diagnostic features of the disease are the usually severe and long-continued pain, although in tuberculous subjects this symptom may be conspicuous by its absence. In addition, also, to the other symptoms ordinarily accompanying a chronic purulent otitis, this disease is apt to be marked by some moderate

elevation of temperature, with slight recurrent chills and an increased pulse-rate. The character of the discharge is also of diagnostic value, since it is usually abundant, fetid, and stained more or less with blood. Another occasional feature of the discharge, and one that will afford us positive evidence of the existence of caries, is the presence in it of a greater or less number of fine particles of bone. At times these are of such size that there is no difficulty in their discovery either by simple ocular examination or through the gritty sensation that they impart to the finger. After preliminary cleansing, illumination and inspection of the canal will almost invariably reveal numerous highly vascular granulations, and perhaps polypi; and should there be any remnant of the membrana, this will be red and vicious in its appearance. In case of any uncertainty regarding the existence of disease of the bone, it may often be dispelled by a careful and thorough use of the probe. This instrument will enable us to detect denuded and diseased bone if it be anywhere within safe reach. Abscesses and fistulous tracts are not infrequently found either within the meatus or situated in the parts about the external ear. Tumefaction and tenderness of the tip of the mastoid process are of weighty significance in the determination of this disease, and should always be carefully looked for. They usually indicate the presence of pus in the apex of the bone, this having many times found its way there as the result of gravitation from a diseased area above.

Treatment. A knowledge of elementary surgical principles will be sufficient to dictate the course to be followed in the management of these cases. Their application will contemplate the reduction of the inflammation, the limitation of the carious or necrotic process, and the prevention of any secondary complications. Of all things, cleanliness and the freest possible drainage are the most important. The external auditory canal should be kept open to its widest extent, and should any obstruction to it be occasioned by granulations, polypi, or the presence of purulent

accumulations in its walls, the first two of these should be thoroughly removed and the last freely opened and evacuated. The coexistent median otitis should be energetically treated by the methods already detailed, and any external abscess formations in the parts about the auricle are to be incised and proper drainage provided. If the carious area is so situated that it can be exposed and reached instrumentally, the diseased and softened bone may be removed as completely as possible by means of sharp spoons. This procedure is to be conducted with extreme care, particularly when it brings us dangerously near to the large blood channels, the facial nerve, or the roof of the tympanum. Loosened sequestra, if too large to make their exit by the natural channel, should either be mechanically reduced in size, or artificial routes should be provided for their escape. Spontaneous openings or fistulous tracts are to be enlarged if necessary, so that every impediment to the prompt discharge of pus and necrotic tissue shall be removed. In order to secure this end it may at times be necessary to perform a more extensive operation—to freely incise the tissues covering the mastoid, to open the antrum and cells, and perhaps to remove the posterosuperior wall of the bony meatus. After all operations, whether in the canal or external to it, the ear is to be well syringed with warm antiseptic solutions, and then dried and dressed as frequently as antiseptic requirements may demand.

With regard to the occasional occurrence of hemorrhage from the ear, this if slight may often be arrested by hot water syringing or by the instillation of six or eight drops of a 1 to 1000 solution of adrenalin chloride. A more active flow of blood may require tamponing of the canal with one of the antiseptic gauzes; and, finally, should the carotid itself be opened, and the hemorrhage be profuse and uncontrollable by milder measures, there should be no delay in applying a ligature to the vessel.

TREATMENT OF FACIAL PARALYSIS. The measures directed to the subduing of the inflammation in the middle ear may, in

the event of this complication, be employed with increased frequency, and, in addition, vigorous counter-irritation over the mastoid, by means of iodine ointment or repeated blistering, may be applied with benefit. Active laxatives and a restricted diet will assist in reducing any acute inflammatory reaction on the part of the nerve, and it will also be advisable for the patient, if not already confined to his room, to remain quietly within doors for a few days. Large doses of potassium iodide have been used in this affection with occasionally gratifying results. Upon the entire subsidence of any symptoms of acute irritation, such as pain and muscular spasm, it will be appropriate to begin the use of electricity. Its premature application will be productive of harm rather than benefit. The weak, constant current should be employed by preference, and a *séance* of from three to five minutes' duration, every second or third day, will usually be sufficient. Improvement is not immediate, however, and even in favorable cases some weeks may elapse before the function of the nerve is restored.

CHAPTER XX.

DISEASES OF THE MASTOID PORTION OF THE TEMPORAL BONE.

BEFORE describing the diseases of this portion of the temporal bone and their complications, it may be permissible, if only for the sake of convenience, to repeat something of what has already been said in the chapter concerning its anatomy. From a surgical point of view there are certain anatomical features in connection with the relations of the tympanum and its accessory cavities to adjoining vital structures that are of very great and practical importance. The lower and larger portion of the tympanum—the atrium—is of comparatively slight surgical interest. It will be recalled that its floor is in close proximity, in front, to the carotid artery, and posteriorly to the jugular fossa. The thinness of its inner or labyrinthine wall concerns us surgically only in the operative removal of granulations from its surface, and warns us to be cautious lest we perforate it. It is the upper portion of the tympanic cavity—the attic—that is of deepest interest to the aural surgeon. This chamber comprises that part of the tympanum which lies above an imaginary horizontal line passing through the short process of the malleus. Its roof—the tegmen tympani—is some distance above the bony ring that gives attachment to the membrana tympani. Its outer wall, therefore, is partly membranous—the membrana flaccida—but principally bony—the pars ossea. The tegmen tympani is an extremely thin plate of bone which constitutes the sole partition between the middle ear and the middle cerebral fossa. Even this is not always intact, for the petrosquamous suture which occurs here is sometimes incompletely closed, and permits the dura

mater and the tympanic mucosa to come almost in contact. Such a defect will strongly predispose to the secondary development of meningitis and brain abscess in middle-ear inflammations. The internal wall of the attic extends from the roof to the fenestra ovale, and its surgical importance depends upon its relations to the transverse semicircular canal and to the aqueductus Fallopii, which lies just above the foramen ovale. The posterior wall is almost wholly monopolized by the opening of the *aditus ad antrum*, the name of which is doubly descriptive of its function and destination.

The *mastoid process* forms the posterior and lower portion of the external part of the temporal bone. It is conoidal in shape, its apex pointing downward. Its anterior border, thick and unevenly rounded, is almost vertical, while the posterior border is inclined upward and backward at an angle of something less than 45 degrees. Its development is much slower than that of other portions of the temporal. At birth, for instance, it is almost entirely absent, and it is not until the third or fourth years of life that it begins to assume its proper shape and proportionate size.

The mastoid process is developed through the union of the squamous and petrous portions of the temporal, the former of these being above and in front of the latter. Their line of junction is recorded on the outer surface of the process by the squamo-mastoid suture which runs from the anterior border, a little distance above the tip, upward and backward and more or less parallel to the posterior border.

It is in the widely varying arrangement of the cellular spaces in the substance of the mastoid process that we are particularly interested with reference to its diseases and their surgical treatment. If their disposition were always the same there would be no excuse for such accidents during the course of operations, as opening of the lateral sinus or unexpected intrusion into the cranial cavity. Unfortunately, however, no two mastoids are

alike in this respect ; and it is further to be regretted that we are almost entirely unable to tell by a study of the surface of the

FIG. 120.



Pneumatic mastoid process. (BACON.)

bone what may be the type of the cellular structure within it. And, speaking of types, it is because of the wide variations that

FIG. 121.



Inner surface of a diploëtic mastoid process, with the groove for the sigmoid sinus lying just above the cells. (BACON.)

exist between different mastoids with reference to the number and size of the air cells in each, that we find them divided into

three more or less distinct classes. These are (*a*) the *pneumatic*, in which almost the whole interior of the process is occupied by spacious cells which communicate freely with one another and with the antrum, and which are lined with a mucous membrane continuous with that of the tympanum; (*b*) the *diploic*, in which the cells are very small and have but very little communication with one another; (*c*) the *sclerosed*, in which there is an entire absence of cellular structure, the bone being compact and devoid of diploic tissue. Of course, there are frequent interminglings of these three types, but there is no occasion for their formal subdivision.

While, as we have seen, this general cellular structure may or may not be present in the mastoid, there is one special cell that is constant in its presence and almost so in its position. This is the antrum, and it is from this that the other cells when they exist radiate, and with which they communicate with greater or less freedom. Surgically speaking, the antrum is the hub around which the lesser cavities of the mastoid revolve. It is the space first infected by extension of a suppurative process from the tympanum, and it is the point at which our first operative measures for the relief of mastoid disease are directed. Knowing this, there is no need to emphasize the necessity for intimately familiarizing ourselves with its usual situation, its anatomical relation to certain external landmarks, and its frequent proximity to internal structures of vital importance.

Although we are enabled by a study of the superficial landmarks to be described presently to locate with sufficient accuracy for safety the position of the antrum with reference to them, we have very few means at our command for determining its depth—the distance which separates it from the surface of the bone. It is known that, as a general rule to which there are but rare exceptions, the antrum during the first year or two of life is but a very trifling distance beneath the mastoid cortex. At this age, indeed, the film of bone overlying the antrum is so riddled with

minute foramina for the passage of vessels that its softness has gained for it the name of the *spongy spot*, and at this point but the lightest scraping with a spoon or curette is needed to expose the cavity. In the adult, however, nature displays a most disconcerting capriciousness with regard to the depth of this chamber, and our only safeguard will lie in a knowledge of the greatest depth to which we can penetrate the bone without perforating it. Schwartz's limit—and his exceeds that approved by other noted operators—is 25 millimetres. The antrum has been found at an even greater depth than this, however, so that if we should make it an inflexible law to suspend our search at this point, we may confess failure at times at the very moment that we are about to succeed. Rather than expose the patient to any unnecessary risk, however, it may be well to be governed by the limit prescribed by Schwartz, and upon reaching it in any case to abandon our direct route to the antrum in favor of the more circuitous but safer one of Stäcke.

The group of external landmarks that will serve at one and the same time to guide us toward the antrum and away from the dreaded lateral sinus, includes the supramastoid ridge, the squamomastoid suture, and the spine of Henle, or, what is equivalent to it, the supramastoid fossa. The first of these—the supramastoid ridge—is but a continuation backward of the posterior root of the zygomatic process. This linear elevation is in itself a reliable guide as to the level of the floor of the middle cranial fossa, since it is almost always placed just below this plane. Slight variations may at times bring it immediately opposite the floor, or, more rarely, a trifle above it. Even in the latter event, however, we can scarcely menace the cranial cavity if we are careful to confine our work to some little distance below this ridge. Of the different landmarks it is the one that is usually the most easily distinguished. It may be less distinct in some cases than in others, but it is invariably present.

The situation and direction of the squamomastoid suture have

already been stated, and it is only needful to add that it forms with the supramastoid ridge two sides of a triangle that is completed in front by the meatus. This suture is of course always in existence, but it is not always in evidence. It cannot at times be distinguished with any certainty. If, however, it be plainly apparent, we will have before us the triangle spoken of, and within the limits of which, Broca asserts, we may confidently search for the antrum without any material risk of wounding the lateral sinus. In those cases, by no means few in number, in which this suture is so indistinct as to be of no dependable assistance to us, we yet have in the suprameatal spine, or the spine of Henle, an additional landmark that will seldom fail and never mislead us.

The suprameatal spine is a very slightly projecting and flattened point of bone that is found just above and behind the postero-superior segment of the bony meatus, and which is separated from the supramastoid ridge above by about a quarter of an inch. Although in the large majority of cases this little landmark can be seen without difficulty, yet there are instances in which its discovery will require a more than commonly skilled eye and finger. The value of this spine as a guide to the situation of the antrum lies in the fact that a horizontal line passing directly backward from it will invariably overlie some portion of that cavity.

To conclude this description of the surgical features of the anatomy of the mastoid process, brief reference may be made to the relations of the antrum to certain structures that are to be carefully avoided during operative procedures. The most important of these, because it is the one most liable to be unexpectedly encountered and injured, is the lateral sinus. If one is thoroughly familiar with the possible variations in the position of this canal in its relation to the antrum, the observance of caution in opening and exploring that cavity will be the natural outcome of such familiarity. The very fact that it is authoritatively asserted

that, in a limited number of cases, the opening of the antrum will be inevitably attended by wounding of the sinus should not only induce us to take every precaution against this accident, but should lead us also to be always prepared for its occurrence. In the absence of care, more or less danger of puncturing this sinus will exist in all cases; but even with the observance of every possible precaution, this danger will be very greatly increased by two occasional irregularities of the sinus. The first of these consists of an unusual depth of the groove in which the sinus lies, this deepening of the channel occurring at the expense of the wall, already thin, that separates it from the cavity of the antrum. The second concerns the placement of this groove much anterior to the point at which it is usually found, thus bringing it perhaps directly internal to the antrum or even somewhat in front of it, instead of being posterior to it, as is the rule. This variation in its position will involve a narrowing of the antral cavity from without inward, and render any instrumental contact with its inner wall particularly hazardous.

The facial nerve is always exposed to some risk of injury when the operator, having opened the antrum, proceeds to remove, also, the outer wall of the aditus. It will be remembered that the horizontal portion of the Fallopian canal passes outward to a point immediately beneath the tympanic threshold of the aditus, and that here it abruptly turns downward. It is the bony wall of this elbow and of the horizontal part of the canal directly connected with it that is particularly thin, and even at times incomplete. The vertical portion of the canal passes downward behind the posterior margin of the tympanic ring, so that it is really within the anterior limits of the mastoid. To ensure the safety of the facial nerve as we remove the wall of the aditus, it is essential that we chisel our way to it at such a height that we will pass above the elbow of the facial canal. If our route inward is not permitted to sink below the level of the suprameatal fossa or the spine of Henle the nerve will be entirely unmolested.

The final piece of dangerous ground lies within the aditus itself, its fragile roof being a portion of the floor upon which rests the temporal lobe of the brain, and its inner wall but thinly separating it from the semicircular canals of the internal ear.

A knowledge of a few points concerning the comparative anatomy of the ear in the child and in the adult will throw considerable light upon the sometimes different behavior of the same aural disease in each. In the child, for instance, although the external auditory canal is almost as large proportionately as it is in the adult, yet its structure is much more largely cartilaginous. The extensive bony portion of the canal that is found in the adult is represented at birth by a slender ring of bone which is not completely closed at a point in its lower and anterior segment until about the sixth year. This foramen communicates with the glenoid fossa, and is, therefore, in close relation with the parotid gland. This relationship will explain the frequency with which an inflammation, in childhood, of either one of these structures, the parotid gland or the ear, is followed by a secondary involvement of the other.

In the immature ear, also, the roof of the tympanum—the tegmen tympani—is not only exceedingly thin in all cases, but in many it is defective at one or more points. Unless these are temporarily filled in with fibrous tissue the dura and the tympanic mucosa will be in immediate contact, and the almost inevitable result of a purulent middle-ear inflammation will be a meningitis or brain abscess. It is of decided importance, moreover, to bear constantly in mind the intimate vascular connection of the tympanum and its accessory cavities with the cranial contents. The numerous tympanic veins terminate, some in the middle meningeal, others in the sigmoid sinus, and a remaining few in the superior petrosal sinus, while the majority of those from the mastoid process empty into the sigmoid sinus. Another important feature of the comparative anatomy of the ear at different ages is that in the bony wall of the Fallopi-
an canal is

not only even thinner than in the adult, but that there are, not infrequently, actual breaches in this wall which leave the sheath of the facial nerve exposed to any inflammatory exudate that may occupy the tympanic cavity. It is for this reason that paralysis of the facial is so much more frequent in children than in adults. A final reminder relates to the comparative lack of development of the mastoid process in early life. It is not only very small in its general proportions, but the cellulation of its inner substance is practically limited to the antrum itself. The close proximity of this cavity to the surface, and the fact that the thin plate of bone covering it is scarcely more than a sieve-like arrangement for the passage of vessels, will wholly account for the greater ease with which, in children, pus will make its way from within the antrum to the external surface of the process.

Acute Inflammation of the Periosteum of the Mastoid Process.

Primary periostitis of the mastoid is of such extremely rare occurrence that we need scarcely do more than admit its possibility. Traumatism, rather than cold, has been the etiological factor in almost all of the few authentic cases that have been observed.

Secondary inflammation of the periosteum enveloping this process is, however, not at all infrequent, and, as a rule, is consecutive to an inflammatory process affecting some portion of the external ear. The occasionally intimate anatomical relations that exist between the tissues of the external ear and the mastoid periosteum will strongly favor the extension of any inflammatory disturbance from the former to the latter. The continuity of the soft tissues lining the deep portion of the external auditory canal with those covering the mastoid process affords a ready means for the addition of a mastoid periostitis to a meatal cellulitis. The irritation and sepsis accompanying a furunculosis of the postero-superior wall of the osseous meatus may pass through the cleft in the vaginal process that is ordinarily to be found in this situa-

tion and implicate the periosteum that covers its external surface. It is a very narrow fissure—scarcely more than an indentation—that here divides the vaginal process from the mastoid, and this is quickly crossed by the pathological process. An inflammation, also, of the mucous membrane lining the mastoid cells may be conveyed to the external periosteal envelope of the process by way of the foramina that frequently penetrate its cortex, or perhaps as the result of the incomplete closure of the squamomastoid suture that has already been described. The comparative absence of the bony meatus in the child will make it evident why this disease is so much more frequent in early than in late life. To be added to the factors already mentioned as causative of this periosteal inflammation, is the unskilful treatment of any superficial inflammation that may have been previously operative.

The subjective symptoms of a secondary mastoid periostitis can seldom be differentiated from those of the primary and closely associated disturbance. The character of the pain is that which usually accompanies severe tension in any other region, and with this is combined a marked degree of tenderness that will be greatly increased by pressure. The notable rise of temperature which is an almost invariable accompaniment of the disease is often preceded by a chill, or perhaps a distinct rigor. The hearing power is not, as a rule, perceptibly affected by a mastoid periostitis. If the disease runs an ordinary course there is no reason why it should be.

The objective appearances are in such plain view and are so distinctive in their character that there should be small probability of an error in diagnosis. The discovery of the primary disease will do much to remove whatever little uncertainty there may be. Should it be a deep-seated furunculosis of the external canal that leads to the periostitis, the extension of the inflammation will be first indicated by the appearance of redness and swelling close to the insertion of the auricle. The folds of the skin found here will rapidly become obliterated, and if the disease

is not controlled the redness will become more brilliant and the intumescence more pronounced, the latter extending not only far back of the ear, but above and even in front of it. The pain is usually severe and the inflamed area is so extremely sensitive that the lightest pressure cannot be endured. The swelling over the mastoid produces an alteration in the position of the auricle that possesses decided diagnostic significance. A side view will show that it is displaced forward by the swollen tissues behind it, while a glance from the rear will detect that it is thrown outward from the side of the head until it stands almost at a right angle with it. In severe cases its normal configuration is almost lost through the addition of more or less œdema.

If efforts to control the inflammation prove unsuccessful, both the symptoms and tissue alterations become even more pronounced, and, sooner or later, the establishment of suppuration will be announced by the discovery of fluctuation in the swelling. There may be some difficulty and delay in the detection of this sign of abscess formation, because of the density of the periosteum in this situation, the tenacity with which it clings to the bone, and the very great thickening of the tissues superficial to it. On deep pressure, however, although we may not obtain unequivocal fluctuation, we are apt to get a sense of unusual elasticity that will be quite sufficient evidence of pus.

If the abscess be not emptied by incision the pus may fail to penetrate the thickened and resistant overlying tissue, and may, instead, effect its escape through the wall of the auditory canal; or, again, it may perforate the mastoid cortex, enter the antrum and tympanum, and make its exit through a frequently coexistent perforation of the drumhead. The time consumed in effecting spontaneous evacuation may be so long that the suspended nutrition of the bone may result in extensive superficial necrosis of it.

Treatment. During the stage of hyperæmia this should be actively antiphlogistic, and will include local depletion by means of the natural or artificial leech and the application of cold by

ice-bags, or, more conveniently and continuously, by the Leiter coil. Certain systemic measures may also be of value, such as rest in bed, restriction of diet, and the administration of active laxatives and perhaps vascular depressants. In case the progress of the disease is not promptly arrested by these methods, the local application of cold is to be suspended, and, in its stead, a bold incision made through the inflamed tissues. This should be deep enough to divide the periosteum and expose the bone throughout its entire length. The relief of tension and the free depletion of the engorged structures afforded by this measure is not only of great service in checking any further progress of the inflammation, and therefore in preventing a threatening suppuration, but in case pus should form in spite of it, it will provide a path for its immediate escape and so avert possible injury to the bone.

Previous to incising it the surface should be rendered thoroughly aseptic and the tip of the mastoid located, so that the knife may not pass beyond it. The incision should be vertical in its direction, an inch or more in length, and distant a scant half-inch from the insertion of the auricle. If, as is not improbable, the posterior auricular artery is divided, this should not disconcert the operator, nor should there be any haste to secure it, for the more abundant the flow of blood the greater will be the good accomplished. Should an abscess have been of some days' duration, immediately upon its evacuation the probe should be carefully used to detect the existence of any carious bone or of a possible perforation of the mastoid cortex. It will be judicious to keep the wound open for a few days by the introduction of a small drainagetube or a strip of antiseptic gauze. Over this a suitable dressing should be applied and renewed as frequently as the quantity of the discharge may make it advisable. A moderate amount of pressure will also be of value in hastening the reattachment of the periosteum to the bone.

Acute Primary Inflammation of the Mastoid Cells.

Although of very exceptional occurrence, the possibility of this disease must be admitted. A few instances of it have been reported at long intervals by competent observers, and it may be just possible, also, that it is a little more frequent than is commonly supposed. Its symptoms and clinical signs are so indefinite, as a rule, that, even under observation, it is not unlikely that cases of it may develop and undergo resolution, in the absence of suppuration, without being recognized. It has seemed to originate spontaneously at times; but it has been usually attributed to the influence of cold, traumatism, or syphilis, and, finally, to the invasion of the cells by some malevolent micro-organism, such as that of epidemic influenza or grippe.

The subjective symptoms are pain—generally dull and aching rather than sharp—and tenderness on pressure over the whole bone, but particularly over the region of the antrum. The hearing is not affected. The objective appearances in the less advanced stages are marked by their insignificance. There may be a faint hyperæmic blush upon the tissue covering the bone, and so slight a degree of swelling that the retro-auricular cutaneous folds are not at all obscured. The fact that the hyperæmia and swelling are diffused over the whole bone serves as a diagnostic factor between this disease and a secondary periostitis, in the latter of which both the swelling and redness are first observed close to the insertion of the auricle. The absence of any lesion in the external auditory canal will also favor the supposition of a primary inflammation of the cells rather than of the periosteum. The pain, moreover, that accompanies the mastoiditis will convey the distinct sensation of being deep-seated instead of superficial as in the periostitis. In the absence of treatment, or should it prove ineffective, the disease, instead of subsiding within a week or ten days, may progress to the point of suppuration. Upon the occurrence of this the symptoms, both

subjective and objective, become intensified, and should the mastoid cortex be thin and the pus succeed in perforating it externally, we will have the evidence of fluctuation added to the redness and swelling. If it is at this stage that we see the case for the first time we cannot assure ourselves by mere inspection whether the condition found has been external in its origin and the result of a periostitis, or whether it is the outcome of a primary inflammation of the mastoid cells. It is only by the deep incision, the thorough exposure of the bone, and the absence or presence of one or more sinuses in its outer wall that we can be at all positive as to our diagnosis. It may be opportune to call attention here to the different routes that may be chosen by the imprisoned pus for its escape. The superficial exit is the one commonly observed in the young and in those adults whose mastoids are of the pneumatic type. In these latter the mastoid cells approach very closely to the surface, and it does not require any great amount of pressure from retained pus to perforate the thin outer wall enclosing them. Should, however, the internal wall be even thinner than that without, the purulent secretion will be apt to enter the posterior fossa of the cranial cavity through an opening in the wall of the sigmoid sinus. In the compact, sclerotic type of mastoid, however, it is the middle fossa of the cranium that is in greatest danger of this purulent invasion, the pus being forced upward and inward, and, finally, in a small proportion of cases, the abscess is emptied through a perforation in the inner wall of the mastoid, close to its tip. (Bezold.) In the latter event the pus bursts into the digastric fossa, burrows downward beneath the deep fascia into the posterior triangle of the neck, provoking pyæmia or septicæmia, or it may be diverted inward and occasion the development of a retropharyngeal abscess. Of these several possible paths for the evacuation of the abscess those which terminate in the cranial cavity are naturally those which may lead to the most serious and perhaps fatal consequences—meningitis, thrombosis,

extradural abscess, or abscess of the brain substance itself are the usual sequelæ of this accident. Particularly in tuberculous subjects we may have facial paralysis as a complicating incident of the disease. It is in children that this symptom is most frequently encountered, because in them, very often, the Fallopian canal is not completely closed, and because, also, their softer bone is much more liable to extensive carious destruction than the denser and more resistant bone of the adult.

Although, as a rule, the prognosis in the mild and uncomplicated case of this disease is not unfavorable, yet when the disease occurs in one who is the subject of a constitutional taint, such as that of tuberculosis or syphilis, caution is to be observed in the making of any prediction as to its outcome.

The management of this affection is identical with that of an acute mastoiditis consecutive to an acute purulent inflammation of the middle ear, and will be found under the description of the latter disease.

Acute Mastoiditis Consecutive to Acute Purulent Otitis Media.

The occurrence of this complication will be greatly influenced by the etiological factor concerned in the production of the primary disease. Provided the patient be constitutionally sound and his general condition at the time good, an acute inflammation of the middle ear dependent upon an acute simple rhinitis and rhinopharyngitis will, in all probability, pursue an uneventful and uncomplicated course and terminate favorably within the customary period. If, however, there are unfavorable features of a constitutional nature, and if, in addition, the otitis is of an infectious type, being the accompaniment of one of the exanthemata, of diphtheria, a septic tonsillitis, typhus or typhoid fever, or, worst of all, perhaps of an attack of epidemic influenza, the probabilities of implication of the mastoid process will be very greatly increased. Indeed, it seems almost beyond reasonable doubt that in *all* cases of acute median otitis, whether they be of simple

or of septic origin, there is more or less inflammatory involvement of the mastoid antrum. The proximity and freedom of communication between the tympanic and antral cavities make it scarcely possible that one of them could be the site of an inflammatory process without some degree of participation in it on the part of the other. In by far the greater number of cases of acute tympanic disease the associated disturbance of the mastoid is, we well know, comparatively slight, and may give rise to scarcely recognizable symptoms. In the smaller number, however, this disturbance of the accessory cavity is so rapidly and perniciously progressive, so threatening in its aspect to the probable termination of the attack, that it acquires an importance quite overshadowing that of the otitis itself.

Symptoms. Of these, pain and tenderness over the region of the mastoid are usually the most distressing, and those that are possessed of the greatest diagnostic significance. The pain, although unmistakably originating in the mastoid process, is seldom limited to it. On the contrary, it commonly radiates from it in all directions, but principally upward over the temporal and backward over the occipital regions. Its intensity and the amount of complaint occasioned by it depend to some extent upon the age and temperament of the patient. The child and neurotic adult will frequently insist that it is agonizing, whereas the more self-contained and matter-of-fact individual may be almost silent concerning it. Quite often there exists an apparent relationship between it and the quantity of discharge; the latter, for instance, being abundant, the pain will be of no consequence; while if the discharge be checked or become scanty the pain suddenly becomes greatly intensified.

The degree and localization of the tenderness are both of very great diagnostic importance. It is essential to distinguish between the tenderness that is attributable to a circumscribed or diffused inflammation of the external auditory canal and that which is due to disease of the bone itself. Not only will a

careful preliminary inspection of the canal do much to differentiate the two, but the examination of the mastoid is to be so conducted that there will be little or no traction made upon the auricle or disturbing pressure communicated to its inflamed meatus. Firm palpation over the whole surface of the process is to be made, and the results usually obtained show that the areas of greatest tenderness are that portion of the bone in close proximity to the insertion of the auricle and, even more distinctly, that which lies immediately over the situation of the antrum.

The assistance afforded by the clinical thermometer in this disease is comparatively slight. In adults, particularly, the temperature findings are too variable, too inconsistent in their relation to the amount of disease present, to permit us to place any great diagnostic dependence upon them. The cases are by no means few in which, in association with very extensive and grave disease of the bone, the temperature record has been indicative of nothing more, perhaps, than a trivial and innocent congestion. While, therefore, the presence, in connection with other symptoms, of any material amount of fever may be justly regarded as significant of bone implication, its absence should not be allowed to lull our suspicions nor to induce us to ignore the testimony offered by other and more trustworthy indications. This, I repeat, is principally true of adults. In children, however, we may be assured that in every case of mastoiditis there will be a decided and at times a very great elevation of temperature. Records of 104° F. or even 105° F. are not uncommon. In early life, also, a very usual accompaniment of mastoid inflammation and suppuration is a marked depression of the general vitality, and in association with this, and no doubt provocative of it, a rapid development of pyæmia or of symptoms of general septic infection.

The information afforded us by the physical signs which accompany invasion of the mastoid by an acute purulent median

otitis, is usually fully sufficient to enable us to make a positive diagnosis of the secondary disease. Certain features connected with the *discharge* from the external canal are, in the first place, of great assistance. A very abundant discharge is, in itself, strongly suggestive that the suppurative process is not limited entirely to the tympanic cavity, but that it has extended into the accessory cavities, and that it is the added purulent secretion from them that so swells the volume of the flow from the meatus. Moreover, if thorough syringing and careful removal of all discharge from the canal and middle ear are almost at once followed by its reappearance, we may feel pretty confident that it comes from other cavities that have been inaccessible to our methods of cleansing. Again, if, after some chilling exposure, a previously free discharge undergoes an abrupt diminution, and this is quickly followed by pain over the region of the mastoid, tenderness on pressure, and perhaps a greater or less rise of temperature, there can scarcely be another inference possible than that the antrum and its adjoining cells have become the seat of an acute inflammation.

Within a few hours after the accession of these symptoms an inspection of the canal and the middle ear will provide us with further evidence that will do much to establish the correctness of such inference. Should the upper portion of the membrana tympani have escaped destruction until this time it will be found distinctly bulging, and, in apparently direct continuity with this, the postero-superior portion of the canal wall will have acquired a marked downward swelling that will greatly lessen the lumen of the canal and proportionately limit our view of the tympanum. If we recall the contiguity of this portion of the osseous meatus to the floor of the aditus and the anterior wall of the antrum the pathological significance of this swelling will be readily appreciated.

Such a group of symptoms writes the diagnosis for us in capital letters, and, in the light of to-day's knowledge, it is not

only unnecessary but inexcusable to wait for the advent of retro-auricular redness and tumefaction in order that we may be further justified in resorting to surgical intervention. Such action should be immediate; it is no time for procrastination, and every moment of delay will but add to the responsibility of the physician and to his possible subsequent reproach. Happily, it is becoming comparatively rare now to meet that mute witness of ignorance or timidity—the postauricular abscess—that but a few years ago was so frequently encountered in both office and dispensary. The greater probability of its occurrence in children is due, as has been explained, to the anatomical peculiarities of the mastoid process at that age. Edema over the region of the mastoid is much less frequently associated with disease of that bone than it is with furuncular inflammation of the external auditory canal.

Until within a very recent period the significance of facial paralysis occurring in the course of a median otitis, as implying involvement of the mastoid cells, was greatly overestimated. Later and more accurate observation has demonstrated that it can occur in tympanic inflammations just as readily without as with mastoid extension.

Not to be dogmatic, we may admit the possibility of an acute mastoiditis consecutive to a purulent median otitis terminating in recovery without abscess formation. Such a termination, however, is extremely rare, and it is probably never observed in cases that are incidental to attacks of epidemic influenza, scarlet fever, diphtheria, or certain other infectious diseases. Once established, the almost invariable tendency of the disease is toward abscess development and more or less extensive destruction and perforation of the bone. Such a course is favored and greatly hastened by the presence within the inflamed cavities of one or a number of varieties of pathogenic micro-organisms. Of these the streptococcus is probably the most common and the most virulent. Microscopical examination of the discharge for

these organisms is often advised, but while their discovery in this way will enlarge our comprehension of a particular case, and serve, at times, to account for its violence and resistance to ordinarily successful treatment, it can, in any other way, be of very little practical advantage to us.

The character of the prognosis in any case will be largely influenced by the nature of the primary otitis—whether it be of simple or infectious origin, but much more largely by the degree of progress that has been attained by the disease previous to our assuming charge of it. The state of the patient's general health as affecting the resisting power of his tissues and his ability to endure the necessary operative measures, as well as the assistance he can afford to the processes of repair, will also very materially influence his chances of recovery.

Treatment. In the event of the case being seen at a time when extension to the mastoid has assumed no greater proportion than a well-developed threat, rest, free drainage, and active local depletion will be the cardinal therapeutic indications. It is imperative that the quiet shall be complete, and no compromise is to be listened to. The bowels are to be freely moved by salines and the diet restricted to fluids of an unstimulating nature. Meat extracts and predigested nitrogenous artificial foods are abominations at such a time. They are not only stimulating ; they are intoxicating.

Freedom of drainage and local depletion are to be secured by one and the same measure—extensive and deep incision of the inflamed tissues. The knife should penetrate the drumhead close to its posterior border and slightly lower than the tip of the manubrium, and is to be carried upward above the level of the short process of the malleus. Turning its edge a trifle backward, the knife is now raised to the periphery of the membrane, and as it is withdrawn the swollen and infiltrated tissues on the postero-superior wall of the meatus are incised to the bone for a distance of a fourth of an inch. In order that the patient shall

not interfere with the thoroughness of this incision, it will be advisable to precede it by the administration of just enough chloroform to obtund sensibility. Upon the withdrawal of the knife the canal should be irrigated for some time with a warm boric acid or bichloride (1 to 5000) solution, not only for purposes of cleanliness and antisepsis, but to encourage further depletion of the inflamed area.

Although it may effect little additional benefit, there can be no legitimate objection to the further abstraction of blood from the tissues external to the mastoid. The artificial leech will do this most conveniently, and the removal of an ounce or two of blood from the region of the mastoid tip, and particularly from over the antrum, may prove of decided assistance in arresting the progress of the inflammatory process.

Although the value of the local application of cold has been a traditional belief for many years, yet recently its utility, but more particularly its safety, has been seriously questioned. It cannot be denied that in the incipency of many cases the persevering use of cold has, to all appearances, been of considerable assistance in controlling the inflammatory process within the substance of the bone. Without entering into any controversy with those who assert that its power in this respect has been greatly exaggerated, we may yet admit the reasonableness of their claim that, in the many cases that progress in spite of the application of cold, it may have the very serious objection of masking those symptoms that would otherwise denote such progress and indicate the need for prompt operation. Recognizing the existence of this objectionable feature, therefore, it will be well to make it a rule to employ cold only in the early hours of the stage of invasion, and to suspend its use at the end of thirty-six or, at the most, forty-eight hours. If, some hours after its discontinuance, there should be a return of pain, tenderness and redness, no further time is to be consumed in a useless reapplication of it, but we are at once to prepare for operative

intervention. Cold is most conveniently applied by means of the aural ice-bag or the Leiter coil. The latter device utilizes the siphon principle in drawing iced water through a coil of tubing that is attached to a light and flexible plate. The reservoir is placed a very little above the level of the patient's head, while the waste pan is below it.

If the several measures here outlined are early and thoroughly applied they may succeed, in not a small number of cases, in

FIG. 122.



Lleiter coil.

arresting or aborting the incipient mastoiditis. It is to be remembered, however, that they are only likely to prove successful in those inflammations that are of a simple catarrhal nature, and not in those that are of infectious origin. In the latter the mastoid inflammation, once begun, is almost certain to rapidly progress in spite of the most strenuous antiphlogistic and antiseptic treatment. The tendency of this type of inflammation also to effect extensive destruction of the mastoid substance and early perforation of its inner wall, leading to purulent invasion

of the cranial cavity, will make habitually prompt operation in these cases an eminently conservative attitude.

To sum up in consecutive order the several indications for the mastoid operation, I give the most important of them here in condensed form :

1. Bulging of Shrapnell's membrane, with swelling of the inner extremity of the auditory canal. Whenever these two conditions coexist we may assume that the mastoid antrum is seriously involved, and that the radical operation will be essential to the patient's recovery.

2. Persistent tenderness over the mastoid process. This symptom in association with a purulent otitis media, acute or chronic, implies extension of the inflammation to the mastoid cells. Although, upon opening the cells, we may discover but little pus, the operation will be more than justified by the increased accessibility of the tympanic vault that it gives, and by which we are enabled to remove from that cavity the pathogenic organisms that crowd it, as well as the *débris* of the destruction that they have occasioned. The less radical procedure will accomplish this, and that surgeon is the more conservative who operates before rather than after complete cellular involvement.

3. Retro-auricular tumefaction. Even if this be not associated with the fluctuation that denotes a superficial abscess consequent upon perforation of the external wall of the mastoid, it is sufficient of itself to hasten the adoption of operative relief.

4. The presence of granulations and polypi in the tympanic attic, together with pus-discharging fistulæ in the deeper portion of the meatus. Such conditions unmistakably indicate carious disease of the attic and antrum so extensive that, in so far as complete cure is concerned, any treatment other than the radical operation will be mere temporizing.

5. Postauricular fistulæ. When the probe demonstrates that these terminate upon the surface of the mastoid they are positive indications of the existence of destructive disease within that

bone. Operation will be the more urgent in those fistulæ that repeatedly close for a time and then reopen, because during the interval of closure the risk of perforation of the inner mastoid wall will be dangerously increased.

6. A profuse and fetid otorrhoea that contains more or less blood and necrosed tissue. A very abundant discharge that almost immediately reappears after scrupulous cleansing of the middle ear will indicate beyond reasonable doubt that it comes from the accessory mastoid cavities as well as from the tympanum itself.

7. Abrupt arrest or decided diminution of a previously free discharge will imply either sudden extension of inflammation to the mastoid cells or an exacerbation of a previously established inflammatory process. In either event the symptom is of such menacing significance that any postponement of operative relief will probably prove disastrous.

The Mastoid Operation.

There is surely no occasion at this day to extol the value of a perfect antiseptic technique in the performance of this operation.

However surgeons may differ as to the relative importance of certain details of the operation itself, there is a complete unanimity of opinion that it should be accompanied by the most thorough antiseptic precautions.

The preparation of the patient will include the careful cleansing of the canal and middle ear, the shaving of the hair from the side of the head over an area that will extend from the attachment of the auricle to two or three inches beyond it, the vigorous scrubbing of this region with ethereal soap and its subsequent flushing with a bichloride solution, after which it is to be protected with moist bichloride gauze until the moment of operation. The sterilization of the instruments to be employed and of the hands and arms of the surgeon and his assistants is to be equally strict.

The succeeding steps of the operation will be greatly facilitated by the making of a long primary incision. This should begin at

the extreme tip of the mastoid process and be carried upward, almost in contact with the postauricular groove, to a point above the centre of the meatus. The tissues are to be divided to the bone. Sharp hemorrhage always follows this incision, but the bleeding vessels, usually including the postauricular artery, are readily closed by hæmostatic forceps. The two flaps are now widely separated and the bone denuded of its periosteum. This much accomplished, we endeavor to distinguish at the bottom of

FIG. 123.

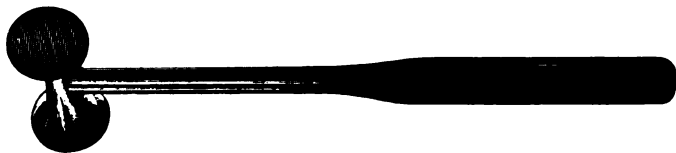


the gaping wound the several landmarks that are to guide our subsequent movements—the temporal ridge, the squamomastoid suture, and the posterior and superior border of the bony meatus, including the spine of Henle or the suprameatal fossa. At times we may see, in addition to these, certain lesions upon the surface of the bone—a spot of softening or one or more sinuses leading to the diseased interior. However great the temptation may be to immediately explore these in the hope that they will lead us to the antrum, it should be an inflexible rule to turn a blind eye to

everything but the region of the antrum itself. Our primary object is to discover and open this most important cell, and when this has been done we have got our bearings and can proceed with comparative safety to open all the others in communication with it.

By far the greater number of surgeons employ the chisel and small leaden mallet for the removal of the mastoid cortex. They are not only more satisfactory, as a rule, but in any but the most expert hands are probably safer than the drills that are used by a smaller number of operators. Two sizes of chisel are necessary for the operation, that used for removing the superficial portion of the bone having a blade about 8 mm. in breadth (approximately one-third of an inch), and that for working at a greater depth an edge of 5 mm. (one-fifth of an inch). The upper anterior angle of the quadrilateral incision of the bone should be on a level

FIG. 124.



with the spine of Henle or the suprameatal fossa, or, in the absence of these, with the superior pole of the meatus. The anterior side of the square, the one first made, is vertical in direction and almost in contact with the posterior border of the meatus. The chisel is held perpendicular to the bone, and by one or two quick, crisp strokes of the mallet is made to penetrate to the depth of about a twelfth of an inch. The upper and lower sides are next made in a similar manner; but when the posterior is reached—the one that is presumably nearest to the lateral sinus—the handle of the chisel is lowered to an almost horizontal position, and its edge is driven forward and but slightly beneath the surface of the bone. In this way the superficial layers of the bone are gradually chipped away. As the wound deepens we will be approaching more nearly to the sinus behind and *

facial nerve in front, and for this reason its dimensions are to be contracted. The smaller chisel is, therefore, soon substituted for the larger, and with this the opening is gradually and cautiously advanced, becoming cone- or funnel-shaped from without inward.

FIG. 125.



Internal wall of tympanum.

A. Head of stapes *in situ*. B. Descending portion of Fallopian tube.

If upon reaching the antrum its exploration reveals pus and softened bone, it becomes imperative, if we are to secure complete and permanent cure, that every remaining cell in the substance of

FIG. 126.



Sharp spoons.

the bone shall be exposed and completely freed either from disease itself or from any disease products that may have entered it. Nothing short of this can assure a satisfactory result of the operation. On no account is the tip of the process to be overlooked.

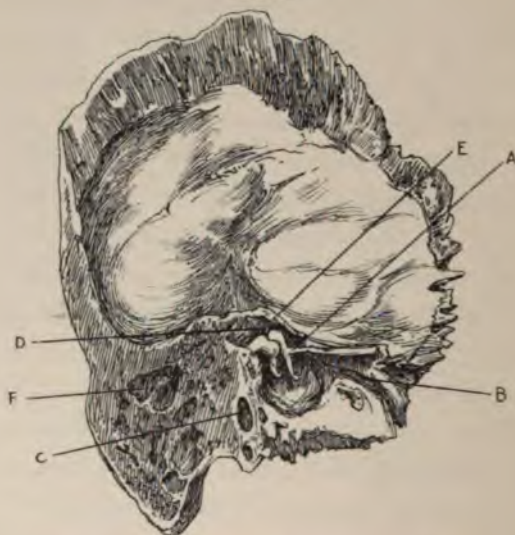
Even though before reaching it we should encounter a strip of sclerotic bone, we are not to be deterred by this from continuing our search to the very lowest point. It is in this portion of the process that a group of large cells is frequently located, and, should they be found diseased, it may be advisable to remove the tip altogether. The instruments that may be used in effecting this extensive exposure of the bone substance are the chisel, bone forceps, or the sharp spoon, and it is this last instrument that should be used most delicately and cautiously in removing all granulations and softened bone from the inner surface of the large cavity thus opened. Upon laying aside our instruments the whole wound is to be thoroughly irrigated with a 1 to 5000 bichloride solution, some of this being injected, if possible, through the aditus into the tympanum. It being taken for granted that the drumhead has already been freely incised, the escape of the fluid will be unimpeded. The excavation in the bone is now to be packed with narrow strips of iodoform gauze, the upper and lower angles of the cutaneous wound sutured, a tampon of iodoform gauze inserted in the auditory canal, and the whole then covered with several layers of bichloride gauze, a pad of sterile absorbent cotton, and then bandaged. At the end of twenty-four hours the dressing is to be examined, and if found well saturated with secretion had better be renewed. Too frequent change of the dressing is to be avoided afterward, however, in order that the process of repair may be disturbed as little as possible, and with each renewal the packing of the bone cavity is to be made more lightly, so that the growth of the granulations shall not be restrained and that the osseous wound shall be completely refilled. If, on the other hand, the granulations are inclined to be exuberant, compression and cauterization will subdue their excessive energy. The reparative process is usually completed in from six weeks to three months, but even this latter period is apt to be exceeded in patients of low vitality or in those with constitutional dyscrasie.

STÄCKE'S OPERATION. In long-standing cases of chronic purulent otitis media which eventuate in implication of the mastoid process, operative treatment that is limited to this portion of the temporal bone alone will seldom succeed in affording the patient anything more than partial and temporary relief. In such cases there is almost invariably extensive disease not only of the ossicles, but of the bony walls of the tympanum and attic and of the aditus and antrum. In these cases, also, cholesteatomata are of frequent occurrence, and the attic and external auditory canal are apt to be the site of numerous exuberant granulations and polypi, and the postero-superior wall of the deeper portions of the meatus of one or more fistulæ. Such accompaniments of the otitis are seriously obstructive to drainage, and their complete eradication will be essential to cure. With the purpose of exposing the entire tympanic cavity and the aditus, as well as the antrum, several surgeons have devised different operations, in the main identical and differing only in detail, and of these that of Stäcke, being usually the most practicable and the most satisfactory in its results, will be briefly described.

The primary incision is of greater length than that employed for the ordinary mastoid operation. It begins above the auricle, but a little distance behind the temporal artery, and extends backward and downward close to the postauricular furrow as far as the mastoid tip. It involves only the tissues superficial to the temporal fascia until the superior pole of the meatus is reached, when it is made to penetrate to the bone. The hemorrhage being restrained, the skin and periosteum of the anterior flap are detached from the bone and drawn forward from the incision until the bony meatus is exposed. The cutaneo-periosteal lining of this portion of the canal is now dissected from its upper and posterior wall as far as the drumhead, so that the remnant of this structure can be distinctly seen. The auricular flap containing the detached portion of the membranous meatus is now drawn still further forward and the thoroughly exposed fundus of the

canal illuminated by the surgeon's electric head-lamp. The next step in the operation consists in the removal of the malleus together with any portion of the membrana that still remains, and the subsequent complete exposure of the attic by the chiselling away of the tympanic process of the squama that forms its outer wall. Upon the extraction of the incus, which is now easily accomplished, the postero-superior quadrant of the tympanic ring and the adjacent portion of the bony meatus are removed by

FIG. 127.



Vertical antero-posterior section of temporal bone.

A. Tendon of tensor tympani muscle. *B.* Eustachian tube. *C.* Fallopiian canal. *D.* Chamber of the attic. *E.* Roof of the attic—tegmen tympani. *F.* Mastoid antrum.

means of the chisel or gouge and the aditus opened to inspection. The attic, aditus, and antrum have now become directly and easily accessible, and all dead and diseased tissue can be removed from them without difficulty. If this shall necessitate the use of the curette or sharp spoon, extreme care and gentleness must be observed in their manipulation, in order that no gratuitous injury shall be inflicted. The concluding feature of the operation consists in the division of the membranous portion of the canal, in

its upper and posterior wall, from the inner extremity of the concha, its re-adaptation to the osseous meatus, and its retention in this position by a tampon of iodoform gauze packed tightly in the canal and extending as far inward as the inner wall of the tympanum. The postauricular wound is now sutured, and all subsequent irrigations and dressings are applied through the meatus.

CHAPTER XXI.

INTRACRANIAL COMPLICATIONS.

THE limits of this book will permit no more than a brief sketch of these important sequelæ of middle-ear and mastoid disease. Although there are occasional instances of extension of this disease from the ear to the cranial cavity during the comparatively brief course of an acute median otitis, yet by far the larger number of cases of intracranial involvement occur in association with a chronic suppurative inflammation of the tympanum. It is in the latter class of cases that insidious carious perforation of the tegmen tympani, the tegmen antri, or that portion of the thin inner table of the mastoid process overlying the sigmoid sinus is so apt to occur, and in consequence of which we have the development of meningitis, extradural abscess (cerebral or cerebellar), abscess of the brain (cerebral or cerebellar), or inflammation and thrombosis of the lateral sinus.

In all severe cases of purulent median otitis, whether acute or chronic, it is highly probable that there is more or less congestion or inflammation of those portions of the meningeal tissues contiguous to the inflamed tympanum or its accessory cavities. This is usually indicated by persistent and severe headache referred, as a rule, to the temporal or occipital regions, over which, also, there may be a certain degree of tenderness. There is commonly a marked evening rise of temperature, succeeded by a morning fall.

When the meningeal inflammation is well marked these symptoms are intensified, and there is quite often added to them severe and frequently repeated chills.

Extradural Abscess.

The causes leading to a collection of pus between the dura mater and the inner cranial wall have already been explained, and when the perforation of the bone and abscess formation occur in connection with a suppurative otitis, one of two sites is apt to be selected : (1) At or in the vicinity of the sigmoid sinus, and therefore in the posterior fossa of the cranium ; (2) upon that portion of the superior surface of the petrous bone overlying the antero-attic cavity, and therefore in the middle fossa of the cranium. The extradural abscess is the most frequent result of otitic cranial invasion, and it is, fortunately, the most amenable to modern methods of treatment.

Symptoms. There is a great dearth of symptoms upon which we can place any reliance in determining the existence of an extradural abscess. In the presence of some slight evidence of meningeal irritation, accompanied, perhaps, by an insignificant elevation of temperature, in a case of purulent median otitis, we can only weigh the probabilities and suspect the existence of an extradural abscess when there is no sufficient reason to suspect anything else. Often enough the discovery of such abscesses is the result of accident rather than design, their presence being revealed, to the surprise of the surgeon, during an operation for disease of the antrum or the attic. A positive diagnosis will be quite impossible until either the antrum or attic, or both, are opened, and the path of communication with the cranial cavity is disclosed and followed to its termination.

Treatment. This, it goes without saying, is exclusively surgical, and the best, in fact, the only rational and prudent procedure, has already been indicated—that of primarily opening the antrum, searching for the infecting sinus, and, when found, permitting it to conduct us to its intracranial termination. If the abscess is found at this point, sufficient bone should be removed with forceps or chisel to secure its evacuation and drainage ; but

should it not be thus opened a curved grooved director, if passed in different directions between the dura and the bone, may locate the pus at some distance from the site of the perforation. The bone external to the cavity is then to be removed, and after its complete emptying a packing of iodoform gauze is to be introduced. The prevention of any further abscess formation will involve the complete cure of the ear disease that has first occasioned it.

Abscess of the Brain.

A brain abscess of otitic origin is most often found either in the cerebellum or in the temporosphenoidal lobe of the cerebellum. The majority of these abscesses are probably the result of direct septic infection through the medium of the veins. Their course is usually of a chronic type, and for several weeks or even two or three months, they may present but few symptoms. Without warning, however, an acute meningitis may suddenly develop, or the increase of intracranial pressure may precipitate coma and death.

Cerebral Abscess.

Symptoms. As has just been intimated, the diagnosis of an otitic brain abscess during the first few weeks of its formation is by no means easy. The fact that what symptoms there may be are associated with a purulent inflammation of the ear lends them an added significance, but they are very often quite irregular and puzzling. Those common to most cases are severe, deep-seated pain in the temporal or occipital regions, irritability of temper, nausea, vomiting, and occasional chilliness. As intracranial pressure increases, cerebration becomes slow, and the patient seems dull and lethargic. There is almost always a distinct lowering of the pulse-rate, and, in place of fever, it is not at all uncommon for the temperature to be subnormal.

Aphasia, appearing in connection with a chronic purulent otitis media of the left side, is regarded as an important sign of a

temporosphenoidal abscess. Optic neuritis may or may not occur, but there is very often an exaggeration of the patellar and

FIG. 128.



Left temporal bone of a patient who died of cerebral abscess. (BACON.)
a, a. Openings in the sclerosed mastoid process, made with chisels. b. Large carious opening leading into the middle cerebral fossa. c. Zygoma.

superficial reflexes on the side opposite to the suspected lesion. Inequality of the pupils and facial paralysis are also of occasional occurrence.

Cerebellar Abscess.

This complication is a frequent sequence of septic inflammation and thrombosis of the lateral sinus. Its symptoms are no more distinctive than those of cerebral abscess, but we may have, in addition to those that are common to the latter, vertigo; a staggering gait; slowing of the respiration, as well as the pulse; Cheyne-Stokes respiration; nystagmus and motor or sensory paralysis.

If unrelieved by operation, cerebellar abscesses, with few exceptions, terminate fatally. The pus may gradually make its way to the surface of the brain and set up an acute leptomeningitis, or the abscess cavity may rupture into the ventricles and the patient perish within a few hours. In the latter event, the temperature suddenly springs upward to 104° or 105° F., or even higher; both the pulse and respiration are greatly quickened, and muscular twitching shortly followed by convulsions and coma usher in the end.

Treatment. The immediate object of surgical intervention in these cases of intracranial abscess is to evacuate and drain them. Their accurate localization is seldom possible, but in spite of this there are certain well-recognized localities in which they are most often found, and in which they may be first looked for in the absence of distinct localizing signs or symptoms. The same rule applies here as to the search for extradural abscesses, namely, that the mastoid antrum and the attic are to be first exposed and given the opportunity to guide us aright by means of the fistulæ through which intracranial infection has taken place. I insert here a detailed description from the pen of C. A. Ballance of the manner in which operation for the relief of these purulent collections is to be conducted. His first two paragraphs relate to the method of sterilizing the site of the operation and to the choice of an anæsthetic, but these being matters in which each operator may prefer to exercise his individual taste, are not quoted.

“3. Incision of the scalp. A flap is to be preferred to a crucial incision. It should be cut with its base downward and should be considerably larger than the opening designed to be made in the skull.

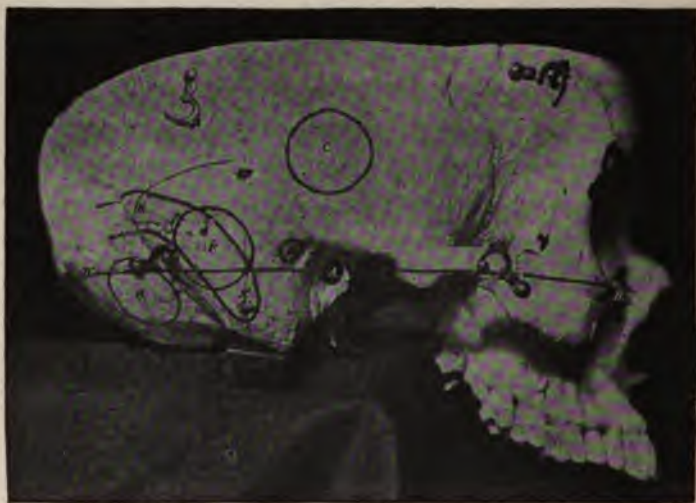
“4. Opening in the bone. Failure may result from neglect of the rule of surgery to make a free opening. The trephine employed should be five-eighths of an inch in diameter, of slightly conical shape, and should have the teeth outside. In temporo-sphenoidal abscess the site of application should be about seven-

eighths of an inch above the suprameatal spine, the object being to expose the lowest part of the middle fossa just external to the tegmen antri and tegmen tympani. Immediately above these tegminæ are the tissues in which, as a rule, the infective process first develops. When the disk of bone has been removed by the trephine, more bone should be cut away with small saws, forceps, or Cryer's drill until the opening in the skull is enlarged to a parallelogram measuring one and three-quarters inches antero-posteriorly and one inch vertically. The lower edge of the parallelogram is marked by that of the trephine opening. Three-quarters of an inch of its antero-posterior extent should lie behind the centre of this aperture and one inch in front. The lowest part of any abscess in the temporosphenoidal lobe can be efficiently drained through this opening, and the bone disease which is the source of infection can be directly observed and removed. In one case a temporosphenoidal abscess was opened at its highest part, and life was only saved by making a counter-opening in the situation here recommended, the man having been some weeks in a condition of cerebral irritation. If the abscess is above and behind or above and in front of the opening, more bone should be taken away, so as to completely expose the surface of brain, which is external to it, or, if the surgeon so prefers, he may make a trephine opening higher up and utilize the lower aperture as a counter-opening. The former method is recommended. In operating for cerebellar abscess the same trephine should be used. It should be placed on the bone so that its anterior edge touches the posterior border of the mastoid process. Its upper edge should be just below Reid's base line. In this way the horizontal and vertical portions of the sigmoid sinus are avoided. The opening should be enlarged backward and downward until it is quite one and a quarter inches in antero-posterior and one inch in vertical extent. The opening may require enlargement, especially in cases where the abscess extends into the posterior part of the lateral lobe. It cannot be carried forward with much advantage, as --

portion of the sinus is in the way of incision of the dura in this direction. It is to be especially remembered that the removal of bone, while comparatively easy before the incision of the dura mater, is not so satisfactorily accomplished when the membrane has been incised and the brain is bulging under pressure.

"5. Incision of the dura mater. Here, again, a flap is preferable to a crucial incision. A small aperture should be made with

FIG. 129.



A. External auditory meatus. *BB'*. Reid's base-line running from lower margin of the orbit through the centre of the external auditory meatus. C. Trephine opening, $\frac{3}{4}$ inch in diameter, to expose temporosphenoidal abscess, centre-pin of trephine being placed $1\frac{1}{4}$ inch above the centre of the external bony meatus. D. Point at which the mastoid antrum should be opened. *EE'*. Position of sigmoid sinus. F. Trephine opening, $\frac{3}{4}$ inch in diameter, for exposing sigmoid sinus, centre-pin of trephine being placed at a point 1 inch behind and $\frac{3}{4}$ inch above centre of external bony meatus. G. Trephine opening for cerebellar abscess, centre-pin being placed 2 inches behind and $\frac{3}{4}$ inch below centre of external bony meatus. (BACON.)

a knife, and the flap (having its base upward) should be cut with fine blunt-pointed scissors. Great care must be taken to avoid wounding the vessels of the cortex, which are forced by the intracranial pressure into close contact with the membrane.

"6. Discovery and incision of the abscess. When there is sufficient opening in the bone it may be possible to determine by palpation that the abscess is immediately subcortical. An

incision should at once be made through the intervening portion of the brain substance into the abscess cavity, care being taken to avoid wounding the vessels in other parts of the body. The use of a trocar and canula, a pus-seeker, or other special instrument is unnecessary and contrary to surgical principles. If the site of the abscess is not obvious, it must be sought for by exploratory puncture, and in so doing it should be remembered that the site of the abscess is almost certainly close to the bone disease which gave rise to it. The best instrument to use is a sharp-pointed, long, and narrow knife. In the brain, as elsewhere, clean-cut wounds heal more readily than any others, and there is certainly less risk of the abscess being missed when search is made for it with a sharp knife than when any other instrument is employed. Cases could be related of (1) the trocar and canula missing the abscess; (2) the trocar and canula passing through the abscess without tapping it; and of (3) the trocar and canula striking the abscess, but failing to penetrate its capsule. The following is an instance of trocar and canula failing to evacuate a large abscess. The brain was explored in various directions with a trocar and canula, with a negative result. At the necropsy there was found a large abscess with very thick walls, containing four ounces of green offensive pus. So thick was the wall that the abscess shelled out whole and could be rolled about the table. In fact, it needed a sharp plunge with the knife to open it. The use of the knife for the evacuation of an abscess of the brain is not a new operation, but was taught and practised more than a century ago.

“7. The further treatment of the abscess. When the cavity is not entirely closed by the waves of brain substance it may be gently irrigated with a weak antiseptic; but on no account should this be done unless two drainage-tubes are so arranged as to ensure the free escape of the fluid. Sterilized normal saline solution is recommended. Unless the opening in the cortex is large, the cavity should not be packed with gauze, because the tampon tends to obstruct the free exit of septic material. In one case of

abscess of the temporosphenoidal lobe a large area was removed. The inner wall of the abscess, which was at first treated by gauze plugging, soon came to form part of the outer surface of the brain, and was thus directly accessible for dressing. The best results ensued.

“As to drainage-tubes, the rules for their use in abscess of the brain do not differ in any way from those which apply to their employment in the healing of suppurating areas elsewhere. When a tube has been successfully introduced it should not be disturbed for some time. The most successful cases treated in this way are those in which the tube remains undisturbed for many days. Tubes are shortened or removed only as the cavity heals from the bottom. The nature of the tube is of little consequence. All tubes are liable to become blocked with brain *débris*.

“In the case of a small abscess deeply placed in the anterior and inner portion of the cerebellar hemisphere, the surgeon may be unwilling to use the knife for evacuation. Recourse must then be had to the exploring trocar and canula, the latter having rings attached by which, when it has penetrated the abscess, it may be immediately fixed to the scalp by silkworm-gut. Many a case has been lost after the pus has been evacuated, owing to failure to re-introduce the tube in the proper position. The trocar and canula should be of platinized silver. In the event of a counter-opening being made, or of drainage occurring through the external auditory meatus, gentle irrigation through the diseased area of brain is beneficial, just as it is in cases of abscess with a counter-opening elsewhere.

“8. Closure of the wound and dressing. An aperture is now made at the base of the flap of the size of the opening in the brain, and the edge of the flap is replaced in position and sutured with fine silkworm-gut. A powder may be used for dusting around the wound, but it should be sterilized. The dressing may be of sterilized cyanide gauze, either used dry or wrung out of

carbolic lotion (1 in 40). A dry sterilized cyanide dressing is recommended, and the bandage should, if possible, be so managed as not to cover the forehead.

“9. After-treatment. This is a matter demanding the close personal attention of the operator. The dressing may require to be changed daily or not at all, according to the nature of the disease and the condition of the wound. The bowels should be kept open by the administration of some preparation of mercury. In septic cases a pill of colocynth and hyoscyamus is very efficient in clearing the intestines of foul-smelling feces. In regard to food, it may be noted that barley-water and beef-tea are often borne by the stomach when milk is rejected. *Hernia cerebri* is an evidence of sepsis. It is best treated by sterilized antiseptic dressing. To prevent the dressing from adhering to the hernia, some form of protective should be used—gold leaf is, perhaps, the best. Slight elastic pressure is useful in the later stages of the treatment.

“10. Recurrence of symptoms. It is by no means uncommon to have a return of the symptoms a few days after the evacuation of the abscess, due either to the refilling of the abscess cavity from faulty drainage, or to the formation of a new abscess in another part of the same lobe. In the cerebellum it is not at all infrequent to have a second or even a third abscess. Instead of concentrating the attention on the original site of abscess, the new symptoms, such as high temperature, rapid and irregular pulse, screaming fits, retraction of head, general twitchings, vomiting, drowsiness, etc., may suggest conditions such as meningitis or acute distention of the ventricles which are not present. The surgeon being led astray by these speculations may fail to act wisely. Many are the vicissitudes of the days and weeks that follow the operation. To be able to choose with certainty and to carry out with precision the various measures which make for success and oppose a disastrous termination, the surgeon must have at his command an exact knowledge of the significance of

the various symptoms that arise, and of the resources and methods available for their systematic treatment."

Sinus Phlebitis and Thrombosis.

Of the two varieties of thrombi, primary or marasmic and secondary or infective, it is the latter in which the aural surgeon is particularly interested, and it is with its occurrence in the sigmoid sinus as the result of a septic phlebitis secondary to purulent inflammation of the tympanum and mastoid cells, that he is most frequently called to deal. The chronic type of suppurative otitis is much more often responsible for this complication than the acute. In fact, it is extremely seldom that the latter is the causative condition.

Etiology and Pathology. The pathological changes that occur in the substance of the mastoid process when it is involved in the course of a purulent otitis have already been sufficiently described, and when we recall its pus-filled cells, alive with pathogenic and often virulent organisms, and its enfeebled walls, softened and thinned by erosion, we cannot fail to fully appreciate the danger to which the sigmoid sinus is exposed by its perilous proximity to this "chamber of horrors." Of the several varieties of septic organisms commonly found within the diseased mastoid, the streptococcus, staphylococcus, and pneumococcus are usually those in greatest number, and it is the first of these that is strongly suspected of being the most aggressive and pernicious. The extension of infection to the sinus wall may be direct, or it may follow the development of an intervening perisinus abscess, or, finally, in the absence of any breach in the inner mastoid cortex, the diploic veins that traverse it on their way to the sinus may become thrombosed and occasion a consecutive thrombosis of that vessel. Implication of the sinus is attended by swelling and desquamation of its endothelium, and by subsequent deposit of the blood fibrin and gradual coagulative occlusion of its lumen. Later, the septic disintegration of this coagulum leads to

pyæmic infection, and, not infrequently, to the formation of metastatic abscesses. Prior to this systemic involvement, the thrombus may extend downward into and at times beyond the internal jugular vein, or its extension may be in the direction of either or both of the petrosal sinuses. In case surgical relief be withheld, the almost inevitable termination of the affection is in death from pyæmia, metastatic abscess formation, brain abscess, or purulent meningitis.

Symptoms. In addition to those of the accompanying and causative mastoiditis, there is a long list of symptoms attributable to the diseased sinus itself. Certain of these are objective, such as œdema, more or less painful, about the posterior border of the mastoid, including the point of exit of the mastoid vein and the upper portion of the posterior cervical triangle. As a result of extension of the thrombus to the cavernous sinus and of consequent engorgement of the ophthalmic vein, there may be considerable œdema of the eyelids of the affected side. Enlargement of the superficial and deep cervical lymphatics is so inconstant as to be of little diagnostic value. Rather exceptionally, there can be distinguished a greater fulness of the external jugular of the sound than of that of the affected side, but it usually requires a keen eye and touch to discover it. Neuroretinitis, if occurring at all, is generally limited to the later stages.

The more frequent general symptoms that characterize the disease are intense headache, irregular fluctuations of temperature—their extent depending upon the degree of systemic sepsis—nausea, vomiting, vertigo, and constipation. The last-mentioned symptom is apt to be succeeded in the later stages by a septic diarrhœa.

Regarding the course of the disease, Whiting says: "The course of sigmoid sinus thrombosis may be conveniently designated, for purposes of clinical classification, as comprising three stages, characterized by local and systemic manifestations; the *acute* stage, when the sinus wall, the pathological changes

invariable, it is that the opening in the bone shall be of sufficient extent to expose, if possible, the whole of the clot containing portion of the sinus. If this rule be observed, the subsequent steps of the operation will be greatly facilitated. To again quote Whiting: "By so much as the sinus is exposed less than two inches, by so much are the mechanical difficulties of the operation multiplied." One other point that may be referred to before briefly describing the operation itself is that which concerns the proper time to operate. If, a positive diagnosis once made, we realize that every moment of delay but adds to the chances of general systemic infection, we will scarcely need any further or better reason for operating at the earliest possible moment.

METHOD OF OPERATION. The usual incision for the mastoid operation having first been made, a second one leaving it at a right angle is carried backward toward the occipital protuberance. Hemorrhage being checked and the flaps retracted, the mastoid is first opened and examined, and then that portion of the bone removed which conceals the sigmoid sinus. When this is exposed and the field of operation has been irrigated with an antiseptic solution, palpation should be the first method by which an attempt is made to determine the location and consistence of the clot. If the results it gives are uncertain, an aspirating-needle is passed through the wall of the sinus and carried first upward in the lumen of the sinus and then downward toward the bulb. If its use reveals the presence of pus or permits the escape of minute particles of a disintegrating clot, there should be no hesitation in exposing and ligaturing the corresponding internal jugular at the level of the clavicle and also well up toward the bulb, and then resecting and removing the intervening portion. If the exploring-needle fails to determine the thrombus, an incision in the wall of the sinus will remove any lingering uncertainty.

Upon the discovery of a clot, the incision in the dura is lengthened and the obstructing mass thoroughly removed by

means of curettes. That portion extending upward and posteriorly is to be first dislodged and the flow of blood restored, and, this being accomplished, the lower section of the thrombus is to be similarly dealt with. Hemorrhage is to be arrested, not by introducing tampons within the lumen of the sinus, but by the pressure of gauze pads applied to its replaced wall. The superficial wound is then partially closed by sutures and antiseptically dressed.

CHAPTER XXII.

DISEASES OF THE LABYRINTH OR INTERNAL EAR.

THE affections of the internal or perceptive portion of the auditory apparatus are usually of greater diagnostic than therapeutic interest, the inaccessibility of this region rendering the treatment of its diseases extremely difficult and unsatisfactory. It will probably be surmised that any serious disturbance of this deep-seated part of the ear is relatively very rare, and also, perhaps, that it is almost invariably secondary rather than primary. As regards this latter point, one authoritative estimate figures that of a thousand cases of aural affections only four will represent primary disease of the labyrinth. Its secondary involvement is most often consecutive to chronic simple or suppurative inflammation of the middle ear. In the one case the frequent depression and fixation of the stapes leads to a serious increase of the intralabyrinthine pressure, and in the other the occasional destruction of the stapes permits of direct purulent invasion of the labyrinth. The centre, the trunk, or the peripheral termination of the auditory nerve are at times affected by traumatism. Certain diseases of the central nervous system occasionally include this nerve, and it is also not infrequently attacked during the course of the constitutional or infectious diseases.

Although in the majority of instances it is beyond our power to accurately locate the nerve lesion—whether it be central, in the course of the nerve, or at its termination—yet the following points are of sufficient diagnostic value to enable us to assure ourselves that it is in one or the other of these portions of the perceptive apparatus that the disease exists :

1. More or less pronounced failure of the sound transmitting power of the bone.
2. Reduction of the upper tone limit, the low pitched voice, for instance, being better heard than the tick of the watch.
3. The impairment of hearing will be emphasized in the midst of a noise, this being usually sufficient to differentiate it from middle-ear deafness which, it will be remembered, often becomes much less noticeable when the patient is exposed to noise.
4. Misapprehension of pitch is an occasional accompaniment of nerve implication, and at times the variation is so great that music may become disagreeable.
5. Patients suffering from disease of the percipient apparatus complain now and then that certain qualities of sound are actually painful. Those of an abrupt or jarring nature are most apt to offend in this way.

While these several symptoms will of themselves be usually sufficient to justify the diagnosis of "nerve deafness," yet when tympanic disease is also present, as, indeed, it almost always is, we are seldom able to estimate with any precision the relative amount of deafness due to each. Accuracy of localization will be somewhat furthered by the coexistence of symptoms that indicate disease of contiguous nerve centres—those, for instance, of sight and smell.

While disease of the internal ear may at times be of idiopathic origin, yet it is most often the result of traumatism, due to blows or falls, or is a complicating feature of one of a long list of systemic diseases. Those in connection with which it is most apt to occur are malarial poisoning, influenza, scarlatina, measles, parotitis, diphtheria, typhoid fever, leucocythæmia, chronic nephritis, diabetes, locomotor ataxia, and syphilis. In children, particularly, the freedom of communication between the vessels of the middle and those of the internal ear predisposes the inner portion of the ear to involvement when the tympanum is the seat of acute inflammation. When this occurs the intralabyrinthine

pressure is liable to be increased not only through vascular distention, but as the result at times of more or less extensive hemorrhage into or infiltration of the membranous labyrinth. In addition to the marked deafness that invariably accompanies such disturbance, the patient will experience varying degrees of tinnitus, vertigo, nausea, and vomiting. It is not to be forgotten, however, that subjective noises and deafness may likewise follow the unguarded use of salicylic acid and quinine, and that they may also appear as symptoms of nicotinism.

Finally, we are to take cognizance of the fact that the auditory nerve and the labyrinth itself may become involved in certain diseases of the brain and spinal cord. They may either directly participate in any inflammatory process, or the function of the nerve may be suspended through pressure exerted upon it by an inflammatory exudate or some variety of new-growth. It is scarcely necessary to recall the frequency with which the internal ear is implicated in cases of fracture of the base of the skull, nor the commonness of nerve deafness among those whose occupation constantly exposes them to loud noises. Boilermakers and gunners in the army or navy are examples of this latter class of patients. Although in certain cases of labyrinthine disease the inevitable deafness may be gradual in its onset, yet there are others in which the symptom appears with extreme abruptness. In traumatism, of course, this is the rule, and it is also of very common occurrence in Ménière's disease, syphilis, and epidemic cerebro-spinal meningitis.

Certain of the features that serve to differentiate disease of the internal from that of the middle-ear have already been touched upon, but attention may be called to one other fact, namely, that the deafness due to labyrinthine disease is much less liable to striking variations of its intensity than is that which is dependent upon affections of the tympanum.

The symptoms that attend disease of the auditory centre or of the trunk of the auditory nerve are, to a certain extent, identical

with those that accompany peripheral or labyrinthine disease. Headache, tinnitus, and vertigo are common to both, and in each of them deafness may be partial or complete. In the diagnosis of central disease much assistance will often be afforded by the functional disturbances that proceed from irritation of the contiguous nervous tissue. Choked disk is an associated symptom of common occurrence and, in addition, we will be apt to discover more or less alteration of the normal tendon reflexes as well as paralyses or anæsthesias of one or both sides.

VASCULAR DISTURBANCE OF THE LABYRINTH.

Hyperæmia.

Varying degrees of labyrinthine hyperæmia are liable to occur in association with acute or chronic otitis media—particularly in the latter if it be purulent, and also in the acute form when it complicates one of the exanthematous fevers. Any obstructive disease of the heart or lungs that leads to cerebral congestion will likewise favor the occurrence of hyperæmia of the internal ear. The inhalation of nitrite of amyl or the administration of full doses of quinine or the salicylates will produce the same result. When the vascular distention is of high degree it is not unusual for slight hemorrhages to occur, and there may be also some infiltration and thickening of the intralabyrinthine structures. The symptoms denotive of this circulatory disorder are tinnitus and transient deafness, vertigo, nausea, vomiting, and unsteadiness of gait. There may be noticeable flushing of the face and of the auditory meatus, and injection of the vessels about the handle of the malleus.

The treatment may be influenced very greatly by the cause of the disturbance, but the measures of general utility are free catharsis, rest, and restriction of the diet. Besides these, we may resort to local blood-letting, the application of cold by the Leiter coil, hot foot-baths, and mustard poultices to the back of the

neck. The internal use of potassium bromide is of occasional value, and, of course, alcohol, tobacco, and stimulating beverages should be prohibited.

Anæmia.

The blood-supply of the labyrinth may be greatly reduced in conditions of general anæmia or after any serious hemorrhage. Its vessels may also be occluded by emboli or they may undergo atheromatous change or be mechanically compressed by tumors at the base of the brain. The subjective symptoms resemble very closely those that accompany hyperæmia, but the face is apt to be pallid instead of red. The treatment will be governed by the cause. Remedies of frequent service are alcohol and nitroglycerin, inhalations of nitrite of amyl, and the adoption of the recumbent position. In diseases of a chronic nature, tonics and some favorable climatic change may prove of value.

Hemorrhage.

The more severe degrees of hyperæmia involving the labyrinth may be accompanied by extravasations of blood. These are usually slight in amount and are apt to occur in association with the acute otitis media that so often complicates attacks of scarlet fever or diphtheria. The intense vascular distention that attends the paroxysms of coughing in pertussis may also be responsible for this accident, and it may likewise proceed from the weakening of the vessel walls that occurs in pernicious or the profound simple anæmias. Traumatism from explosions or direct violence is another not infrequent cause.

The most significant symptom is the suddenly developed deafness. This may be partial or complete, and is usually accompanied by varying degrees of tinnitus, vertigo, and nausea.

The treatment will aim first to remove the congestion or vascular weakness that may have been at fault, and then to promote the absorption of the effused blood. Depending upon the cause, complete rest, ferruginous tonics, the Leiter cold coil, or

venesection will be appropriate at different times to prevent further leakage, and the absorption of recently escaped blood may often be effected by the internal administration of potassium iodide and the simultaneous hypodermic use of pilocarpine.

Meniere's Disease.

The abruptness of its development is one of the most striking features of this disease. It has no well-recognized predisposing causes, although deficient ventilation may now and then be found to have preceded it. It is probably most often attributed to prolonged exposure to the summer sun or to over-exertion during intensely hot weather. It may attack the healthy as well as those who are in poor condition. Pathologically, the disease consists of a sudden extravasation of blood, or perhaps an acute exudation into the semicircular canals.

In the majority of cases the patient, without any premonitory symptoms, is suddenly attacked with vertigo and vomiting, quickly becomes unconscious, and falls, as a rule, toward the affected side. The face becomes pallid and in a few moments is covered with a profuse perspiration. Upon regaining consciousness, and this is seldom long delayed, profound deafness—usually bilateral, is found to have occurred, and with it is associated loud tinnitus, nausea, and loss of equilibrium. The duration of the attacks varies in different cases, covering at times not more than a few minutes, while at others it may be prolonged for several hours. Their frequency of repetition is also capable of considerable variation, in certain individuals but one attack being observed, while in others they may recur at intervals of a few days or weeks. It is but seldom that there is any noticeable alteration in the condition or appearance of the tympanum, and there is also an entire absence of any paralysis of the other cranial or spinal nerves. Bone conduction is usually completely abolished, and air conduction, except to very loud sounds, is also apt to be suspended. Upon the conclusion of each attack the nausea and

vertigo gradually diminish, and perhaps disappear, but the tinnitus and deafness persist.

The treatment of the attack itself will comprise absolute rest in bed with the head slightly elevated, the administration of fractional doses of calomel followed by a saline, and the application of cold about the ear and of sinapisms to the back of the neck and the extremities. Upon the subsidence of the acute symptoms, protracted general as well as local treatment will still be necessary to relieve the vertigo, tinnitus, and deafness. The remedies that have proved most successful in doing this are quinine, potassium iodide, the bromides, and pilocarpine. A method of using them that has met with general approval and has often afforded gratifying results, is to give during the first week following the attack from 10 to 12 grains of quinine each day in three doses. The iodide of potash is then substituted for the quinine, and 5 grains of it three times a day are given during the second week.

At the end of this time the hypodermic use of pilocarpine is begun, provided always that the patient is not suffering from any cardiac or pulmonary disease. He is put to bed and an eighth to a sixth of a grain of the drug injected either each day or every second day. The stomach should be empty at the time the hypodermic is given, and it may be repeated if necessary some ten or twelve times. The sweating and salivation usually continue for two hours or more, and until they have ceased the patient should remain in bed. If, on account of existing heart or pulmonary disease, pilocarpine cannot safely be resorted to, the free sweating may be secured by Turkish baths or by employing the cabinet vapor baths of recent introduction for home use.

Another method by which pilocarpine may be used is its injection through the Eustachian catheter into the middle ear. Five or six drops of a 2 per cent. solution are sufficient for this purpose.

Otitis Interna.

Primary inflammation of the membranous or acute endostitis of the bony labyrinth, although of extreme rarity, have been known to occur. Inflammation of this portion of the ear is almost invariably secondary, and ordinarily occurs as a complication of scarlet fever, diphtheria, or tubercular caries or necrosis of the temporal bone. The suppurative process is accompanied by new formation of connective and bony tissue, by thickening of the walls of the membranous labyrinth and destruction of the organ of Corti and of the cochlear nerve.

Chronic inflammation of the labyrinth may ensue upon the purulent otitis media of the infectious fevers, or it may occur in association with diseases of the brain or its membranes. The same proliferative and degenerative alterations occur in this as in the acute form of inflammation, and these lead to atrophy of the membranous labyrinth and ultimate disappearance of Corti's organ.

The diagnosis of acute labyrinthine inflammation is rendered difficult by the resemblance of its symptoms to those of meningitis. The former, however, is of abrupt rather than gradual development, and its later course will make the distinction between the two a matter of no uncertainty. The symptoms of the labyrinthine disturbance are most pronounced in children, and consist of fever, vertigo, vomiting, delirium, loss of consciousness, and convulsions. It will be discovered upon the return of consciousness that the child is completely deaf.

The treatment of this affection will comprise the local abstraction of blood, the application of cold, calomel with a saline following it, and absolute rest. Counter-irritation behind the ear is of value, and should the disease be the outcome of a purulent median otitis, this latter must be actively treated. In the event of temporal caries or necrosis being present, an operation sufficiently extensive to expose and remove the diseased tissue must be performed.

Syphilis of the Internal Ear.

Although luetic disease of the labyrinth is not of common occurrence, yet in cases of suddenly developed deafness, particularly during youth, without any discoverable disease of the middle ear, it should always be suspected. It is usually during the tertiary or the late secondary stage of syphilis that the labyrinth is attacked. Specific infiltration of its tissues accompanied, perhaps, by exudation occurs, and there is a slow development of new connective tissue and bone. The bloodvessels become involved in the disease, the vestibular periosteum undergoes a noticeable thickening and induces a coincident fixation of the stapes in the fenestra ovalis. In time the nerve terminals in the cochlea atrophy, and later, perhaps, exhibit degenerative changes.

The principal symptom of the disease, the deafness, although most often of sudden appearance, may in rare instances develop gradually. It is, as a rule, bilateral, and is usually attended by tinnitus and more or less vertigo. Tests of the hearing will disclose that the watch and acoumeter are almost, if not quite, inaudible, that bone conduction is very much diminished, and that the upper tone limit is greatly reduced. In cases of hereditary syphilis the diagnosis will often be greatly facilitated by the presence of corneal opacities, due to interstitial keratitis, and also of notched incisors—the “pegged teeth” of Hutchinson.

Mercury, potassium iodide, and pilocarpine will constitute the treatment. The preferable way of using the first of these remedies will probably be by inunction over the mastoid process, while the pilocarpine may be employed either hypodermically or by injection into the tympanum through the catheter of five or six drops of an 8 per cent. solution.

CHAPTER XXIII.

MEDICAL FORMULARY.

AQUEOUS CLEANSING SOLUTIONS FOR USE IN THE UPPER AIR PASSAGES.

THE features that should be possessed by any solution that is intended for a merely cleansing effect upon the upper air tract are, that its density shall be closely approximate to that of the blood-serum, and that its ingredients shall be capable of exerting a solvent action upon any retained and thickened secretion. While these are the essentials for such a solution, the addition of other judiciously selected remedies may give it several other desirable properties. For instance, it may be made antiseptic, astringent, stimulant, or deodorant.

The simplest model for all such formulæ will be found in the widely used "Dobell's solution :"

R.—Sodii bicarb.,
Sodii bborat. aa ʒj.
Acid. carbol. (cryst.) gr. xv.
Glycerini f ʒj.
Aquæ q. s. ad. ʒiv.—M.

Sig.—Add to a quart of water, and use in atomizer.

In this the two soda salts supply the solvent action upon the mucous secretion, the carbolie acid adds a mildly antiseptic and deodorant power, and the glycerin brings the specific gravity up to the required standard.

As substitutes for the above solution a very large number of compressed tablets are made by as many different manufacturing chemists, the formula of each containing one or more of the alkaline salts in combination with various aromatic agents, such as thymol, menthol, eucalyptol, etc. One of these tablets dissolved in two ounces of water is designed to give a solution whose

qualities will closely resemble those of the original Dobell prescription.

They are, no doubt, easier and safer of transportation than a liquid preparation, and possibly, also, they may possess the additional advantage of economy.

Resorcin and creolin are available as antiseptics for use in the nasal wash, the former in the strength of 5 to 20 grains to the ounce, the latter 1 to 5 minims. We have a wide choice of astringents that are suitable for this purpose, and if the one that we first select should prove unsatisfactory it should be exchanged for another. The following are those most commonly used, the quantity of each to the ounce being indicated. It is well to remember, however, that mineral astringents are not well borne by the nasal mucous membrane, and that although all these mentioned are of happy effect in the pharynx and larynx, they had better be cautiously used in the nasal fossæ. Alum, 5 to 15 grains; copper sulphate, 5 to 10 grains; zinc sulphate, 5 to 10 grains; zinc sulphocarbolate, 5 to 10 grains; ferric chloride, 2 to 5 grains; acid tannic, 3 to 6 grains. It has been mentioned that the distilled fluid extract of hamamelis is a very agreeable astringent for the pituitary membrane, it being diluted one part to three or four of water. The fluid extract of hydrastis is also an excellent astringent.

Stimulants.

Menthol is probably the pleasantest of the several agents that are used for their stimulating effect upon the vascular supply of the respiratory mucous membranes. A very common mistake is to employ it in too great strength. Five grains to the ounce is amply strong for its initial use, and, although it may be subsequently increased to twenty or more grains to the ounce, it is seldom necessary to exceed ten or fifteen.

Iodine is the most generally useful of the glandular and vascular stimulants and alteratives. It may be employed either

in spray or pigment, and for the atomizer the "Boulton solution" is an excellent one :

R.—Acid. carbolic. (cryst.)		gr. xvij.
Tr. iodin. comp.		f℥j.
Glycerini		f℥iss.
Aq. dest.		f℥ij.—M.

Place in a water-bath of 100° in a tightly-corked bottle until the solution becomes colorless ; then filter.

Another formula intended for use in the atomizer, and that is of particular value in atrophic rhinitis, is :

R.—Iodin.		gr. viij.
Potass. iodid.		gr. xvj.
Zinc. sulphocarbolat.		℥ss.
Creolin		℥xlvj.
Aque		q. s. ad f℥vj.—M.

It will be seen that the ingredients of this formula combine to make it at once a stimulant, antiseptic, and deodorant.

It is as a pigment that iodine is probably most widely used in the nose and throat, and the three following formulæ contain it in different strengths :

	I.	II.	III.
R.—Iodin.	 gr. viij.	gr. xij.	gr. xvj.
Potass. iodid.	 gr. xxiv.	gr. xxxvj.	gr. xlvij.
Glycerini	 ℥ss.	℥ss.	℥ss.

In order to mask the unpleasant metallic taste of the iodine, 4 or 5 minims of the oils of gaultheria or menth. pip. may be added to the solution.

Formalin is another remedy of very extensive utility in the various affections of the nose, throat, and ear. Depending upon the nature of the disease and the sensibility of the region attacked, formalin may be used in strengths varying from 1 to 4000 to 1 to 500. It is a vigorous antiseptic and is also a powerful deodorant, which latter characteristic makes it of much service in atrophic and syphilitic rhinitis.

Ichthyol is frequently used in nose and throat work because of its antiphlogistic, antiseptic, and alterative qualities. It is a

thick, brown liquid, of a bituminous odor, and is soluble in water and miscible with glycerin, oils, and fats. It is usually employed in 5 to 50 per cent. ointments and lotions. It is strongly recommended for atrophic rhinitis, a 20 per cent. watery solution of it being first rubbed with considerable vigor into the dry and anæmic mucous membrane, and then a tampon well moistened with a 10 per cent. glycerite is introduced within the lower meatus and allowed to remain for some hours.

The deodorizing power of permanganate of potash is so well known that there is little need to suggest the propriety of its use in those diseases with which fætor is associated ; such, for instance, as atrophic and tertiary syphilitic rhinitis or empyema of the accessory sinuses.

Oils.

In addition to the use of water as a solvent, we may employ for a certain number of our remedies the highly refined petroleum oils as vehicles. The oil itself has probably nothing more than a brief protective effect upon the mucous membrane, and it is a great mistake to regard it, as some seem to do, as a powerful cleansing agent. Under this misapprehension of its action, many practitioners commit the blunder of giving to their catarrhal patients for home use, not the Dobell solution or one of its modifications, but an oily solution of camphor or menthol or both. This may be soothing and rather agreeable, but for cleansing purposes it is utterly worthless. It has no solvent action upon the scales and crusts that so often obstruct the nose, nor will it liquefy the thick, tenacious mucus that is found in the catarrhal nasopharynx.

Albolene, benzoinol, and several other similar preparations make excellent vehicles, however, for a number of medicaments that we may wish to apply to the mucous membranes as soon as they have been properly cleansed. Camphor, menthol, thymol, and eucalyptol are the remedies most frequently used in oily

solution, but to these may be added numerous others, such as creosote, guaiacol, terpinol, ol. cubeb, etc.

A very satisfactory combination for use in acute inflammatory disturbance of the nasal and nasopharyngeal mucous membrane, is :

R.—Camphor,
Menthol aa gr. x.
Benzoinol ʒj.—M.

As the inflammation subsides and becomes subacute the proportion of the menthol and camphor may be increased to 15 or 20 grains to the ounce.

In the chronic catarrhal conditions of the upper cavities a very excellent formula that may be used to conclude the local treatment is that of Douglas :

R.—Thymol gr. x.
Menthol gr. xx.
Eucalyptol gtt. xx.
Ol. cubebæ gtt. xl.
Benzoinol f ʒj.—M.

This makes a rather pleasant and refreshing spray as it is, but it may be rendered even more so by the addition of eight or ten drops of oil of rose.

R.—Guaiacol ℥xx.
Menthol gr. xx.
Ol. olive f ʒj.—M.

A very efficient combination for intratracheal injection in cases of tuberculous laryngitis.

Pigments.

These are solutions in water, glycerin, or oils that are intended to be applied by means of the camel's-hair brush or the ordinary cotton-carrier. The nitrate of silver is used most often by this method, and the specialist should have upon his table a number of silver solutions of different strengths, from 5 grains up to 2 drachms to the ounce.

Chloride of zinc is a remedy of much value for use in pigment form in the more chronic conditions of the faucial region, the pharynx, and the larynx. It may be employed in watery solution in from 2 to 10 per cent. strength.

The glycerite of tannic acid is an excellent stimulating astringent, and is of much service in relaxed conditions of the mucous membranes with sluggish glandular action.

The tincture of the chloride of iron combined with an equal quantity of glycerin is another astringent that has a usually favorable effect upon the lacunar inflammations of the tonsil—acute or chronic.

Lactic acid is an exceedingly valuable agent in lupoid and tuberculous ulceration. Its use may be begun with a 10 or 20 per cent. solution, and its strength gradually increased until, with previous cocainization, the pure acid may be employed.

Inhalations.

Somewhat recently there has been a revival of interest in the application of remedies by those methods that are included under the term pneumotherapy. There can be no question as to the usefulness of drugs administered in this manner. Not only do we obtain their local effect upon the mucous lining of the air passages, but, through their absorption by this membrane, we are enabled to exert also their constitutional effect. The skepticism or, at least, the lack of favor with which the inhalation of drugs in the form of vapor or when finely nebulized has been long regarded, has probably been due to the difficulty of obtaining anything but crude and unsatisfactory apparatus for carrying out this mode of treatment. Within the past several years, however, inventive genius has been attracted to this field, and has placed at our service a large variety of inhalers, vaporizers, and nebulizers that are not only thoroughly efficient, but are simple and inexpensive as well. From a physiological point of view, this method of treating the many diseases of the respiratory tract is certainly

to be cordially approved. While sprays, pigments, and powders are effective forms in which to apply various remedies to the air passages, yet none of them are physiologically in harmony with the mucous membrane found therein. Drugs administered in these forms are practically foreign bodies, and are, therefore, unavoidably more or less irritating. It is true that in certain of the more chronic affections this irritation may emphasize the intended effect of the drug, and, therefore, be desirable, but in acute or subacute disturbances it cannot but be objectionable by neutralizing to a certain extent the action of the sedatives or astringents employed in this form. Vapors or finely nebulized medicaments, however, are practically held in solution by the inhaled air and come gently in contact with the diseased tissues without producing any mechanical disturbance of them. Clinical observation confirms what theory suggests concerning the value of pneumotherapy, and now that the apparatus required has reached such a high degree of perfection, it should be resorted to much more frequently, not only by the specialist, but the general practitioner as well. The very simplicity of its application makes it a method for home as well as office use, and, with a few instructions, a patient of average intelligence can co-operate with his physician and materially hasten his own relief and cure. The remedies employed in this manner must not only be carefully selected and accurately adapted to the disease, but they must also be of absolute purity. And, in addition, if we wish to obtain the best results from this treatment, some pains must be taken to teach the patient the art of inhalation. It is astonishing how large a number of people there is who are more or less stupid about the proper method of using an inhaler. Men, as a rule, acquire the knack with a fair amount of quickness, but the majority of our women patients must not only be repeatedly told but shown how to employ the apparatus correctly. Many of them will take the mouth-piece between the lips and then inhale the air through the nose. In such people it may be necessary to

close the nose in order that the medicated vapor may be drawn through the mouth into the chest. Again, the inhalatory effort of many of our patients is apt to be too shallow. The vapor reaches the pharynx, or, perhaps, the upper larynx, but is then expelled, instead of being drawn through the trachea and larger bronchi even to the small capillary tubes. The desirable depth of the inhalation will, of course, vary according to the portion of the air tract involved, but it will be usually time well spent for the physician to supervise his patient's first few essays in the use of his inhaler.

The simplest wet inhalation is that of steam itself for its moistening and relaxing effect upon an inflamed larynx or trachea. The reader has already been cautioned as to the use of actually boiling water for this purpose. The therapeutic activity of this inhalation can be increased by the addition to the hot water of certain remedies that will impregnate the steam arising therefrom. Those most commonly employed are the tr. benzoin. co., chloroform, creosote, terebene, ol. pini sylvestris, etc. Very elaborate and expensive steam nebulizers can be found in the shops, but while mechanically they are very ingenious, practically they are but little better than a pint tin-cup and an improvised funnel.

Most of the so-called dry or cold inhalations have for their basis the vapor of nascent chloride of ammonium. The ordinary inhaler is provided with two chambers, the upper containing pure hydrochloric acid and the lower a dilute solution of aqua ammonia.

The fumes from the acid being drawn through the ammonia solution, the ammonium chloride is liberated in vapor, and this may be medicated by adding to the fluid in the lower chamber any of the essential oils or other volatile agents. Such inhalations are often very effective in relieving the dryness of the chronically catarrhal mucous membrane. Chronic laryngitis and nasopharyngitis are very favorably influenced, as a rule, by this method of stimulation.

Through the medium of the modern nebulizer we are enabled to apply to the air passages a number of remedies that are not soluble in water or the lighter oils, and are, therefore, not adapted for use in the ordinary atomizer. These nebulizers are suitable for home as well as office use, and in the hands of intelligent patients often prove of great assistance in the treatment of the catarrhal affections not of the nose and throat only, but of the ears as well. The following formulæ will be found serviceable in the cases for which they are advised :

R.—Eucalyptol 3j.
 Ol. pini sylvestris,
 Ol. cassiæ āā 3ss.
 Menthol gr. xx.
 Tr. benzoin q. s. ft. f 3 iv.

In the later stages of acute rhinitis and rhinopharyngitis where the secretion is not only thick and tenacious, but excessive in quantity.

R.—Iodin. gr. xx.
 Acid. carbolic. gr. xxiv.
 Menthol,
 Camphor āā 3j.
 Benzoinol q. s. ft. f 3 iv.

In chronic catarrhal conditions; should the middle ear be affected, it may be inflated with this nebula with much benefit.

R.—Eucalyptol,
 Ol. cassiæ,
 Creosoti,
 Ol. picis liq. āā 3j.
 Albolene q. s. ft. f 3 iv.

This will lessen the irritation attending tuberculous invasion of the larynx.

R.—Iodin. gr. xx.
 Ol. picis liq. 3j.
 Camphor,
 Menthol āā 3j.
 Ol. gaultheriæ 3j.
 Benzoinol q. s. ft. f 3 j.

Alterative and antiseptic. Of value in chronic catarrhs throughout the upper air passages.

Lozenges.

The several advantages possessed by lozenges over gargles have already been mentioned, and the following examples are but a few of a very large number that may be employed with much satisfaction. Each formula represents one lozenge :

R.—Ammon. chlorid. gr. ij.
 Ammon. iodid. gr. j.

Alterative expectorant.

R.—Ammon. chlorid.,
 Ammon. bromid. aa gr. ij.

Expectorant and sedative.

R.—Ammon. chlorid. gr. ij.
 Ammon. iodid. gr. j.
 Heroin gr. $\frac{1}{12}$.

Expectorant, alterative, sedative.

R.—Acid. benzoic. gr. $\frac{1}{2}$.
 Oleores. cubeb. gr. $\frac{1}{2}$.
 Potass. chlorat. gr. ij.

Laryngeal and vocal stimulant.

R.—Tr. ferri chlor. ℥ij.
 Potass. chlorat.,
 Sodii bromid.,
 Ext. glycyrrhizæ aa gr. ijss.

For acute lacunar tonsillitis.

R.—Ext. lactucarii gr. jss.
 Codeine gr. $\frac{1}{2}$.
 Ext. hyoscyami gr. $\frac{1}{2}$.

Sedative for cough due to dry, irritable throat.

Powders for Insufflation.

These have a rather limited range of utility, but in certain cases may be used with much benefit. It is in the nose and larynx that they are principally of value, because the time that they

remain in the fauces or pharynx is usually too brief to permit them to exert any material effect. The powders may possess various qualities, being either antiseptic, cicatrizant, anæsthetic, or merely protective. As a dressing for operative wounds, or for the ulcerative lesions of syphilis, tuberculosis, or malignant disease, iodoform or one of its several substitutes is of decided service. Aristol, nosophen, europhen, or iodol are less disagreeable than iodoform, and in our more sensitive patients may be used in its stead. A formula that is of very general usefulness is :

R.—Iodoform,
 Acid. tannic. ãã gr. xx.
 Bismuth. subnitrat.,
 Pulv. acaciæ ãã ʒ ij.
 Morphinæ sulphat. gr. xx.—M.

This is antiseptic, cicatrizant, and, if the morphine be included in it, anæsthetic.

A very agreeable protective powder for use during the earlier stages of acute rhinitis or in hay fever is the compound stearate of zinc combined with menthol and balsam of Peru.

In the chronic catarrhal conditions of the larynx, with more or less thickening and sluggish congestion of the cords, a stimulating astringent such as sulphate of zinc may be incorporated with an inactive powder like amylum or sacch. lactis, and insufflated twice weekly with excellent effect.

For the extremely painful tuberculous and malignant ulcerations of the larynx, orthoform has proved a valuable anæsthetic.

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